Allen-Bradley

ControlNet Modules in Logix5000 Control Systems

1734-ACNR, 1756-CNB, 1756-CNBR, 1784-PCC, 1784-PCIC, 1784-PCICS, 1788-CNC, 1788-CNCR, 1788-CNF, 1788-CNFR, 1794-ACN15, 1794-ACNR15, 1797-ACNR15

User Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.ab.com/manuals/gi) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual we use notes to make you aware of safety considerations.

WARNING

Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
- avoid a hazard
- recognize the consequence

SHOCK HAZARD

Labels may be located on or inside the drive to alert people that dangerous voltage may be present.

BURN HAZARD

Labels may be located on or inside the drive to alert people that surfaces may be dangerous temperatures.

Purpose of This Manual

This manual describes how you can use ControlNet™ with your Logix5000™ controller. With this manual, you can learn how to communicate between your controller and various devices on the ControlNet network.

Who Should Use This Manual

You should use this manual if you are an individual who programs applications that use ControlNet with one of the following Logix5000 controllers:

- ControlLogix® controller
- FlexLogix™ controller
- PowerFlex®700S with DriveLogix™ controller
- SoftLogix5800™ controller

You should also:

- have a basic understanding of networking concepts
- have a basic familiarity of the following software:
  - RSLogix™ 5000
  - RSLinx®
  - RSNetWorx™ for ControlNet

What Information This Manuals Contains

Table Preface.1 describes the information available in this manual.

Table Preface.1

Section:	Title:
Chapter 1	About the Logix5000 ControlNet Communication Modules
Chapter 2	Connecting a Computer to the ControlNet Network
Chapter 3	Configuring a ControlNet Module
Chapter 4	Controlling I/O
Chapter 5	Interlocking Controllers (Produce and Consume Tags)
Chapter 6	Peer-to-Peer Messaging
Chapter 7	Communicating with PanelView and RSView Products
Chapter 8	Troubleshooting Your ControlNet Communications Modules
Appendix A	Specifications
Appendix B	Connection Use Over ControlNet
Appendix C	ControlNet Overview
Appendix D	Determining Your ControlNet Media Requirements
Appendix E	Controlling 1771 I/O Over ControlNet

Chapter 5

Interlocking Controllers (Produce and Consume Tags)

Chapter 6

Peer-to-Peer Messaging

Chapter 7

Communicating with PanelView and RSView Products

Chapter 8

Troubleshooting Your ControlNet Communications Modules

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Connection Use Over ControlNet

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ControlNet Overview

Appendix D

Determining Your ControlNet Media Requirements

Appendix E

Controlling 1771 I/O Over ControlNet

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About the Logix5000 ControlNet Communication Modules

Using This Chapter

This chapter introduces the Logix5000 ControlNet communication modules and describes how you can use these modules in a control system:

The remaining chapters in this publication describe how to configure and program the ControlNet communication modules. A listing of catalog numbers at the beginning of each chapter identifies the modules that support the feature described in that chapter.

Choosing a ControlNet Communications Module

The Logix5000 family offers several ControlNet communication modules. Select the module you need based on the ControlNet functions your application requires.

Table 1.1 describes the ControlNet communication modules' functionality.

Table 1.1

ControlNet Module:	Functions as an I/O bridge[1]:	Functions as a messaging bridge[2]:	Functions as an I/O adapter[3]:
1756-CNB, 1756-CNBR	X	X	X
1784-PCC		X	
1784-PCIC		X	
1784-PCICS	X	X	
1788-CNC, 1788-CNCR, 1788-CNF, 1788-CNFR	X	X	
1794-ACN15, 1794-ACNR15			X
1797-ACNR15			X
1734-ACNR			X

(1) When it functions as an I/O bridge, the module can (in conjunction with the controller) originate connections to remote I/O.

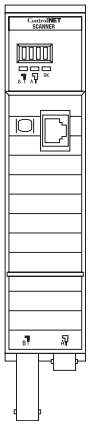
(2) When it functions as a messaging bridge, the module can function as a gateway from one network to another network or backplane without a controller program. To enable gateway functionality for the 1784-PCC card, RSLinx Gateway is required.

(3) When it functions as an I/O adapter, the module can interface to I/O and serve as the target of a remote I/O connection from a controller.

The ControlNet communications modules:

- support messaging, produced/consumed tags and distributed I/O
- share a common application layer with DeviceNet and EtherNet/IP
- interface via RG-6 coaxial cable or 200/230 micron HCS (hard-clad silica) fiber optic cable
- require no routing tables
- support the use of coax and fiber repeaters for isolation and increased distance

1756-CNB, 1756-CNBR Overview



1756-CNBR shown 43605

ControlLogix ControlNet Communication modules bridge ControlNet links to route messages to devices on other networks. The modules also monitor and control I/O modules located remotely from the ControlLogix controller. This module supports:

- I/O bridge and adapter functionality (depending on location) to manage distributed I/O modules
- transfer of scheduled data via produced/consumed tags
- unscheduled MSG instructions communication with other ControlNet nodes
- messaging data for configuration and programming information, operator interfaces, upload/download, etc.
- local communication network access through the network access port (NAP)
- redundant media (1756-CNBR only)

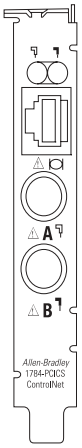
1784-PCC Overview

43678

The 1784-PCC communication interface cards are personal computer memory card international association (PCMCIA) interface cards that enable laptop computers to communicate directly with other ControlNet products. These cards support:

- messaging data for configuration and programming information, operator interfaces, upload/download, etc.
- unscheduled messaging communication with other ControlNet nodes
- local communication network access through another ControlNet device's network access port (NAP)
- serves as a ControlNet traffic analyzer, catalog number 9220-WINTA

1784-PCIC, PCICS Overview



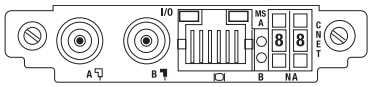
42281

1784-PCICS shown

The 1784-PCIC and 1784-PCICS communication interface cards are peripheral component interconnect (PCI) open-bus interface cards that enable PCI local bus compatible computers to communicate directly with other ControlNet products. The 1784-PCICS card also provides ControlNet I/O bridging as well as monitoring and configuration capabilities. These cards support:

- transfer of scheduled data via produced/consumed tags (1784-PCICS only)
- unscheduled MSG instructions communication with other ControlNet nodes
- messaging data for configuration and programming information, operator interfaces, upload/download, etc.
- I/O bridge functionality to manage distributed I/O modules (1784-PCICS only)
- local communication network access through the network access port (NAP)
- redundant media

1788-CNC, 1788-CNCR, 1788-CNF, 1788-CNFR Overview



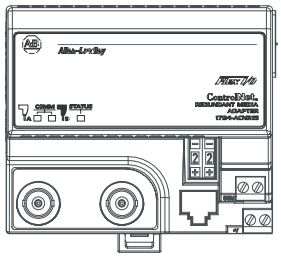
43679

1788-CNCR shown

The ControlNet communication card links the FlexLogix controller and PowerFlex 700S with DriveLogix controller to other devices on a ControlNet network. The ControlNet communication card also provides access for the FlexLogix controller to monitor and control I/O modules located remotely from the controller on the ControlNet network. These cards support:

- I/O bridge functionality to manage distributed I/O modules
- transfer of scheduled data via produced/consumed tags
- unscheduled MSG instructions communication with other ControlNet nodes
- messaging data for configuration and programming information, operator interfaces, upload/download, etc.
- local communication network access through the network access port (NAP) - not available on the 1788-CNFR
- redundant media (1788-CNCR and 1788-CNFR only)
- fiber media for optical isolation and increased noise immunity (1788-CNF and 1788-CNFR only) used in conjunction with the ControlNet short distance fiber repeaters
- uses 200 micron cable (1786-FSxxx) with V-pin connectors and 1786-RPFS/RPA to connect to the network (1788-CNFR only)

1794-ACN15, 1794-ACNR15 Overview



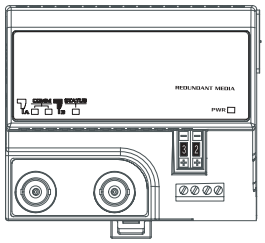
43607

1794-ACNR shown

The 1794-ACN15 and 1794-ACNR15 modules operate as adapters for FLEX I/O modules on a ControlNet network. This module supports:

- control of I/O within its chassis–you can connect up to 8 FLEX I/O modules to one 1794-ACN15 or 1794-ACNR15 module
- unscheduled messaging data for configuration
- local communication network access through the network access port (NAP)
- control of individual I/O modules by different controllers
- redundant media (1794-ACNR15 only)

1797-ACNR15 Overview

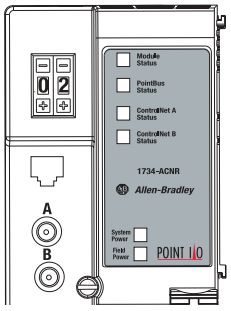


41411

The 1797-ACNR15 modules operate as adapters for FLEX Ex I/O modules on a ControlNet network in an intrinsically safe environment. This module supports:

- control of I/O within its chassis–you can connect up to 8 FLEX Ex I/O modules to one 1797-ACNR15 module
- unscheduled messaging data for configuration
- control of individual I/O modules by different controllers
- redundant media

1734-ACNR Overview



43248

The 1734-ACNR module operates as an adapter for POINT I/O modules on a ControlNet network. This module supports:

- control of I/O within its chassis, with up to 63 POINT I/O modules connected to the adapter
- unscheduled messaging data for configuration
- local communication network access through the network access port (NAP)
- redundant media

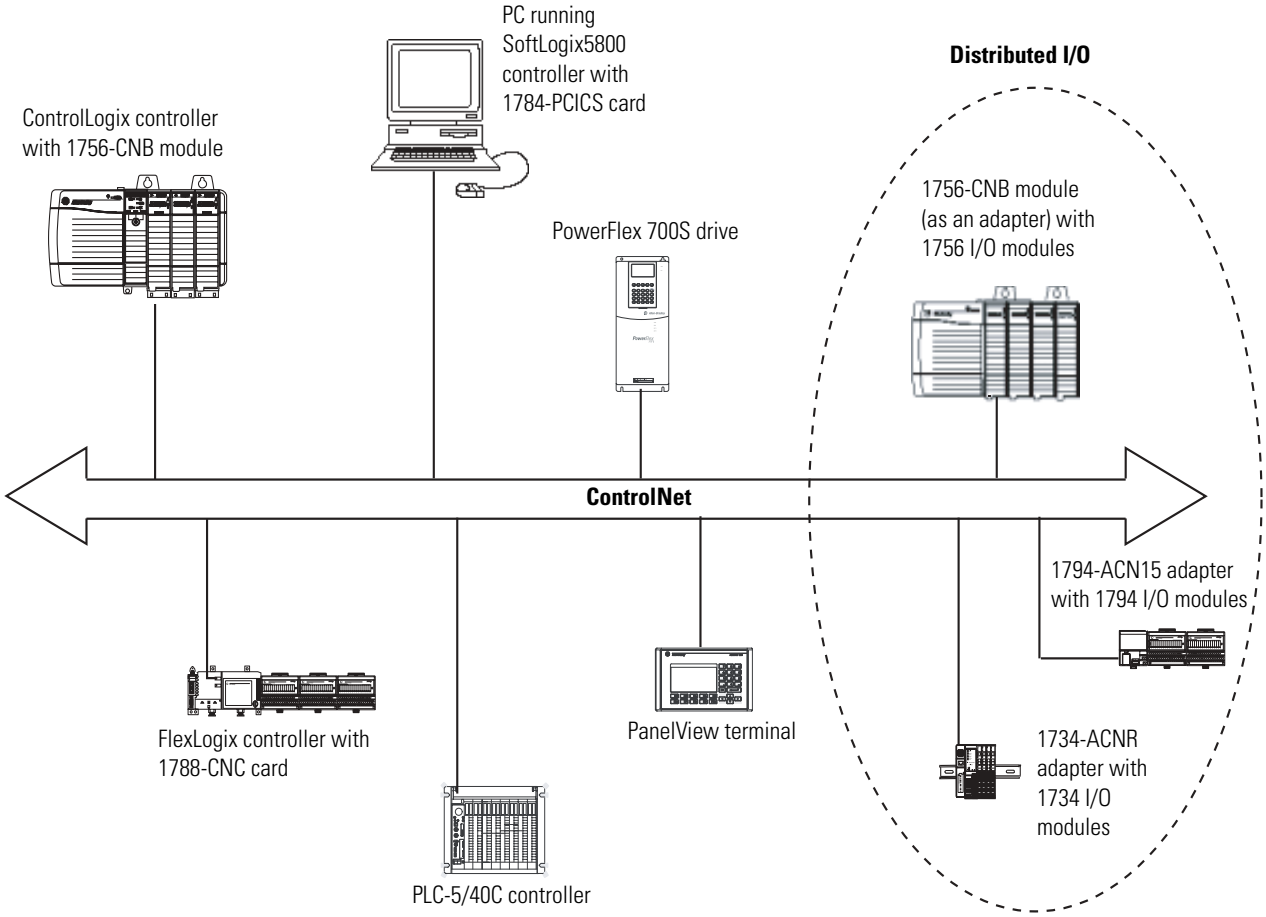
The 1734-ACNR module appears as an I/O module, rather than as a ControlNet communication module, in RSLogix 5000–the programming software for Logix5000 control systems. Additionally, the 1734-ACNR module is compatible with Logix5000 systems only; the module will not work with PLC or SLC controllers.

For more information, see the 1734-ACNR user manual, publication 1734-UM008.

Using the ControlNet Communication Modules in a Control System

Figure 1.1 shows how the different ControlNet modules can fit into a control system:

Figure 1.1



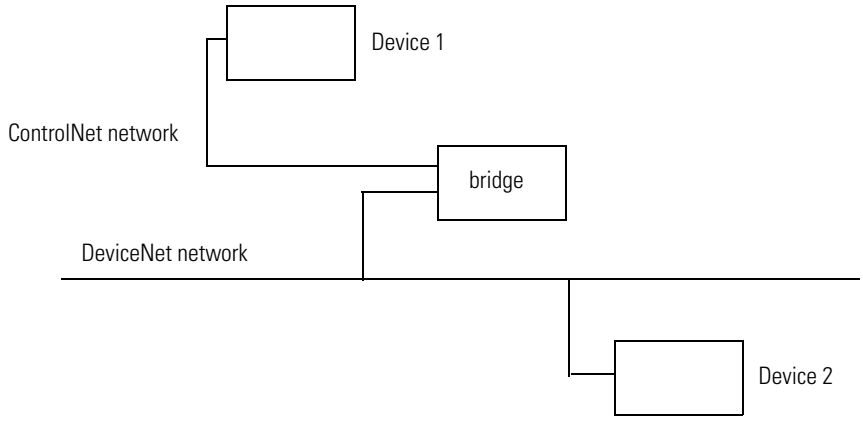
In this example:

- The controllers (i.e., ControlLogix, FlexLogix, SoftLogix or PLC-5C) can produce and consume tags among each other.
- The controllers can initiate MSG instructions that send/receive data or configure devices.
- The personal computer can upload/download projects to the controllers.
- The personal computer can configure devices on ControlNet, and it can configure the network itself.

Bridging Across Networks

Some ControlNet modules support the ability to bridge or route communication to and from different networks, depending on the capabilities of the platform and communication devices.

With unscheduled communications, you have a bridge when you have a connection between communication devices on two separate networks. For example, the bridge device shown below has both ControlNet and DeviceNet connections so that Device 1 on ControlNet can communicate with Device 2 on DeviceNet through the bridge.



Communication can bridge these networks:.

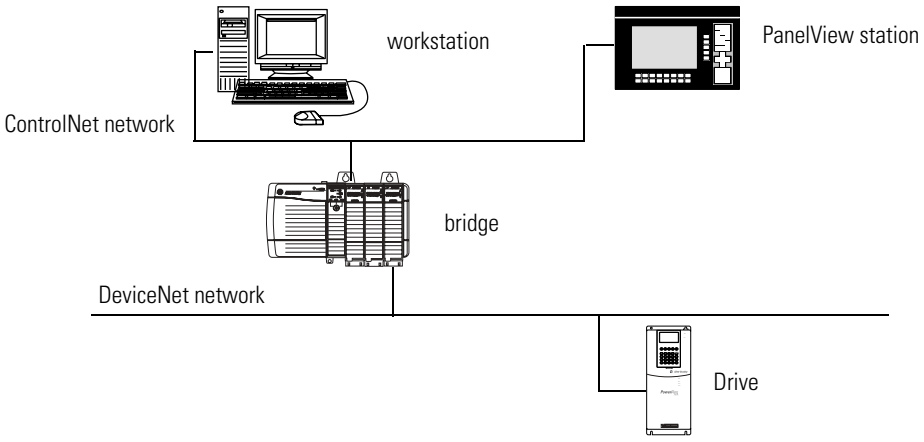
A device on this network	Can access a device on this network:			
	EtherNet/IP	ControlNet:	DeviceNet:	RS-232[2]:
EtherNet/IP	yes	yes	yes	yes
ControlNet	yes	yes	yes	yes
DeviceNet	no	no	yes	no
RS-232	yes	yes[1]	yes	yes

(1) To use RSNetWorx software to configure and schedule a ControlNet network, we recommend that you either:
- connecto an EtherNet/IP network and bridge to a ControlNet network
- use a 1784-PCC interface device to connect directly to a ControlNet network.

(2) Typically, this is a point-to-point connection between a Logix5000 controller and another device, such as a PanelView™ Plus operator terminal.

In this example, a workstation configures a drive on a DeviceNet network. The workstation bridges from ControlNet to DeviceNet to reach the drive.

Figure 1.2



In this example, the bridge can be a ControlNet to DeviceNet bridging device (e.g. 1788-CN2DN) or a Logix5000 system with a ControlNet communication module and a DeviceNet communication module. Table 1.2 describes how to use Logix5000 systems in this example.

Table 1.2

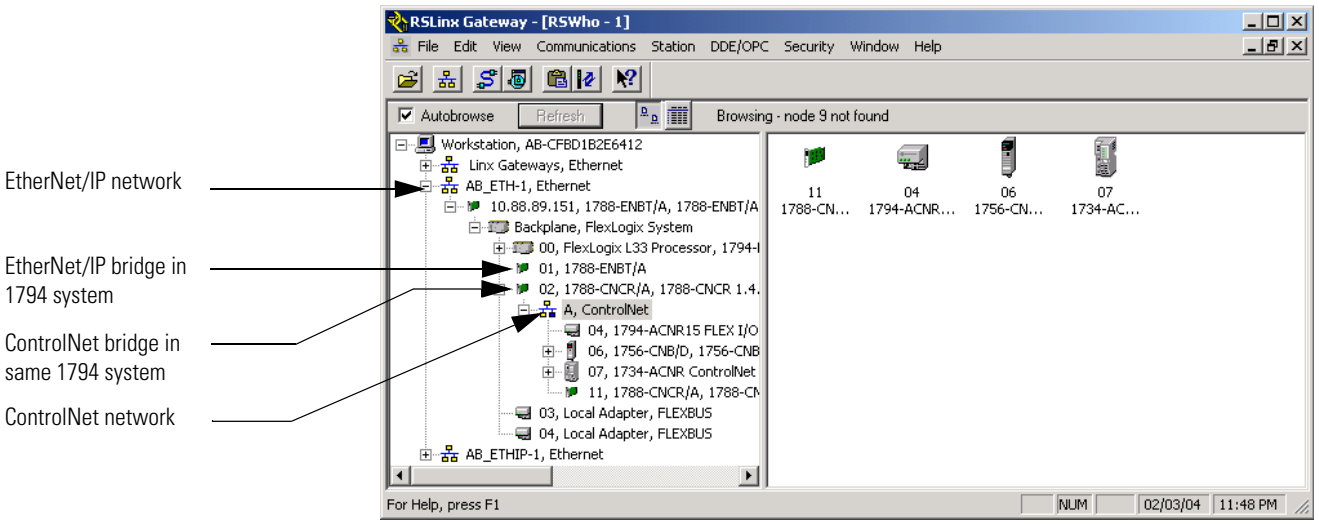
If the bridge is:	You need these components:
ControlLogix system	• a 1756-CNB module • a 1756-DNB module
FlexLogix system	• a FlexLogix controller • a 1788-CNx card • a 1788-DNBO card
SoftLogix system	• a SoftLogix controller • a 1784-PCIC(S) card • a 1784-PCIDS card

Keep in mind that **you can only bridge messages across networks**. You **cannot bridge I/O connections** from one network to another.

IMPORTANT The FlexLogix controller's performance degrades significantly if you use the controller as a bridge. Bridging over the FlexLogix controller should be targeted toward applications that are not real time dependent (e.g. RSLogix 5000 program downloads).

In Figure 1.2, status data can also be transferred from DeviceNet through the Logix5000 controller to a RSView32 operator interface. For a FlexLogix controller, map the data into the DeviceNet I/O image and then use RSLinx OPC from the PC to the Logix5000 controller over ControlNet. This avoids using the limited bridging resources of the FlexLogix controller.

The example RSLinx screen below shows how the EtherNet/IP bridge links to the ControlNet network:



You can bridge messages across networks. However, you cannot bridge scheduled I/O data from ControlNet to another network. Design your system with this in mind–I/O modules must be configured in either a local chassis or a remote chassis. In other words, I/O connections must span no more than one network.

You cannot go through a gateway chassis to control I/O, even though in some circumstances, RSLogix 5000 software accepts such a configuration in the I/O Configuration folder.

You can use ControlLogix modules in a ControlLogix chassis or communications cards in FlexLogix or SoftLogix controllers to bridge between networks. Table 1.3 lists the possible bridges between communications networks.

Table 1.3

To bridge from this network:	To this network:	You can use the following[1]:	
		In a ControlLogix chassis	**In a FlexLogix controller:**
ControlNet	DeviceNet	• 1756-CNB(R) module • 1756-DNB module or • one 1788-CN2DN module[2]	• 1788-CN(x) card • 1788-DNBO card or • one 1788-CN2DN module[2]
	EtherNet/IP	• 1756-CNB(R) module • 1756-ENBT module	• 1788-CN(x) card • 1788-ENBT card
EtherNet/IP	ControlNet	• 1756-ENBT module • 1756-CNB(R) module	• 1788-ENBT card • 1788-CN(x) card
	DeviceNet	• 1756-ENBT module • 1756-DNB module or • one 1788-EN2DN module[3]	• 1788-ENBT card • 1788-DNBO card or • one 1788-EN2DN module[3]

(1) You can bridge from a ControlNet network to an Ethernet network and from an Ethernet network to a ControlNet via a SoftLogix virtual chassis. However, the products and methods you must use to do so are more detailed than can be effectively described in this table. For more information on how to bridge from one network to another via a SoftLogix virtual chassis, see the SoftLogix 5800 System User Manual, publication number 1789-UM002.

(2) Can serve as a dedicated standalone bridge from ControlNet to DeviceNet.

(3) Can serve as a dedicated standalone bridge from EtherNet/IP to DeviceNet.

Connecting a Computer to the ControlNet Network

Using This Chapter

Read this chapter for:

- *1784-PCC, 1784-PCIC, 1784-PCICS cards*

This chapter describes how to configure a personal computer to operate on a ControlNet network.

You need to load a ControlNet communications driver for a personal computer to communicate with other devices on a ControlNet network. A personal computer needs this driver to:

- upload and download controller projects over ControlNet via RSLogix 5000 programming software.
- schedule the ControlNet network via RSNetWorx for ControlNet.
- operate an HMI type application.

Before you load a communication driver, make sure the:

- ControlNet communication card is already installed in the personal computer
- personal computer is properly connected to the ControlNet network

For more information on how to install the ControlNet communication cards, use the installation instructions for each card. The respective installation instructions are listed in Table C.3 on page C-14.

Connecting a Computer to Any Network

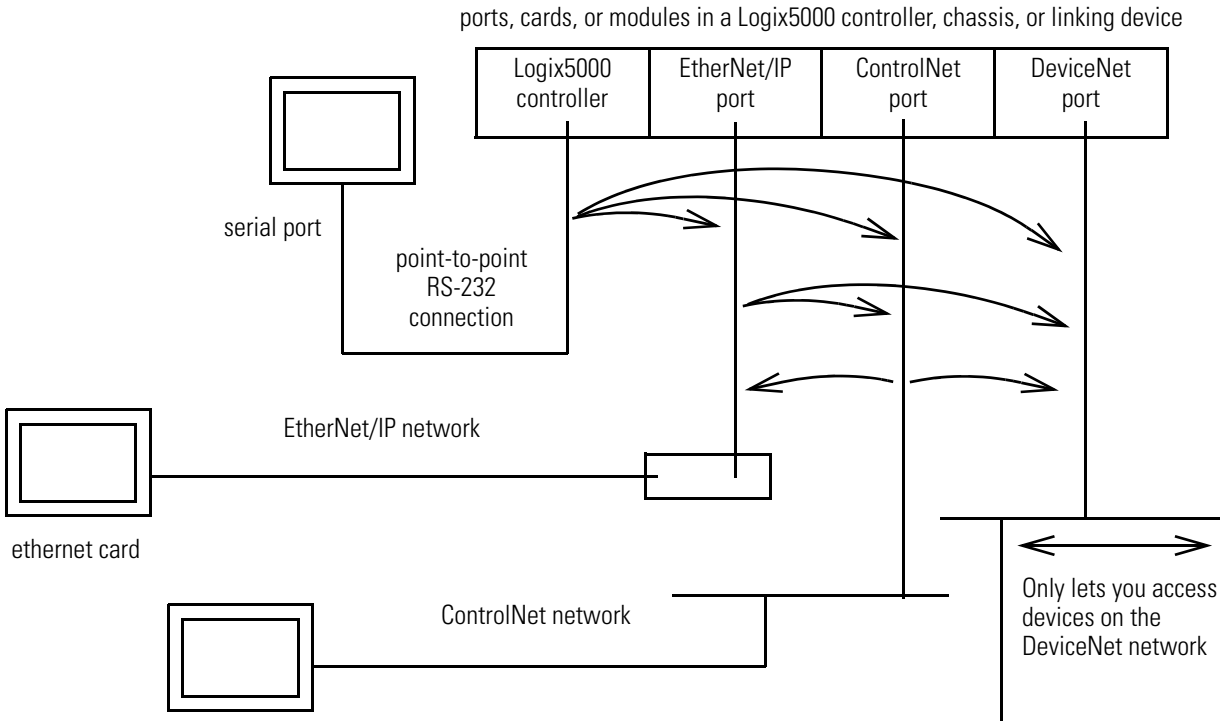
To access a network, either:

- connect directly to the network
- connect to a different network and browse (bridge) to the desired network. This requires *no* additional programming.

IMPORTANT To use RSNetWorx software to configure and schedule a ControlNet network, *either*:

- connect to an EtherNet/IP network and bridge to the ControlNet network
- use a 1784-PCC interface device to connect directly to the ControlNet network

The figure below shows your options.



Laptop	Desktop
1784-PCC	1784-PCIC
1770-KFC15(1)	1784-PCICS
	1784-KTCX15
	1770-KFC15

(1) This module offers an RS-232 connection to standalone devices (e.g., multi-vendor automation equipment, PCs, modems).

Laptop	Desktop
1784-PCD	1784-PCID
1770-KFD(1)	1784-PCIDS
	1770-KFD

(1) This module offers an RS-232 connection to standalone devices (e.g., multi-vendor automation equipment, PCs, modems).

Configuring the ControlNet Communications Driver in RSLinx

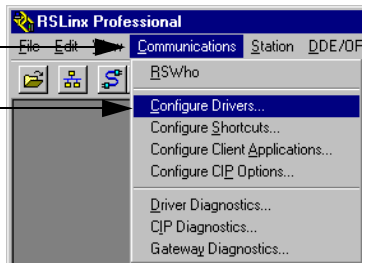
To configure the ControlNet communication driver for the personal computer (programming workstation):

IMPORTANT Do not use these steps to configure a ControlNet communication driver for any application that uses a SoftLogix5800 controller. With the SoftLogix5800 controller, you can configure a ControlNet communication driver via the SoftLogix5800 Chassis Monitor. For more information on how to do this, see page 2-5.

1. In RSLinx software, select Configure Driver.

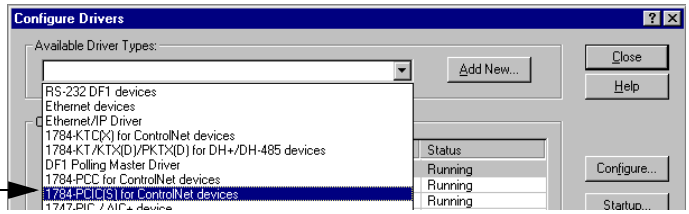
A. Click *Communications*

B. Click *Configure Drivers*

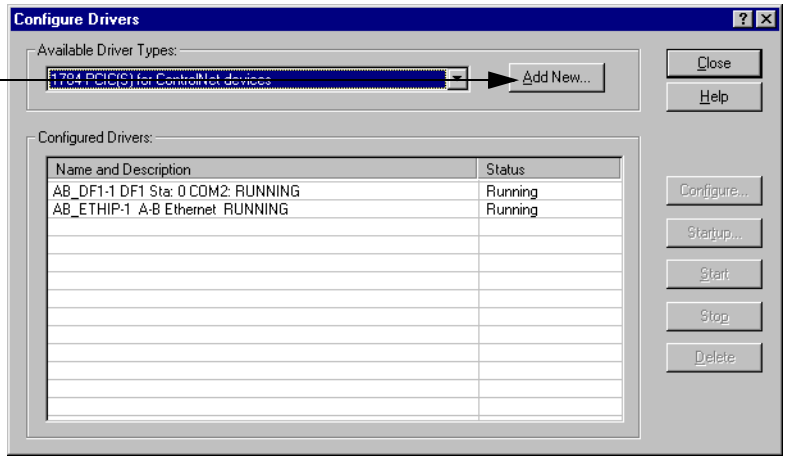


2. Select a driver for ControlNet devices. In the example below, we choose the 1784-PCICS card. You can also connect your PC to a ControlNet network via the 1784-PCC card.

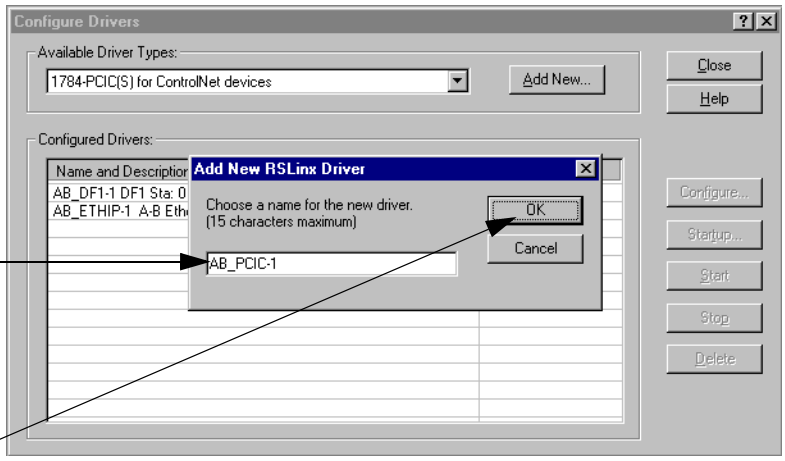
A. Use the pull-down menu to select the ControlNet driver.



B. Click *Add New.*



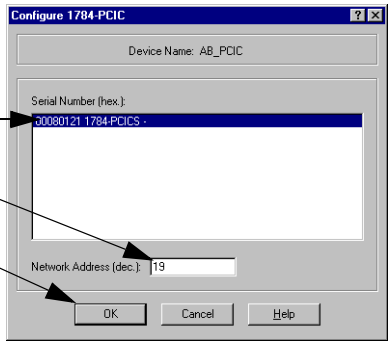
3. Name the new ControlNet driver.



A. Name the driver. This example shows the default name (i.e.,AB_PCIC-1 that RSLinx uses.

B. Click *OK*.

4. After you create the driver, configure it to correspond to the ControlNet module within your computer.



A. If multiple cards are located in your computer, choose the correct one.

B. Make sure you use the correct Network Address.

C. Click OK.

The appearance of this screen varies widely depending on the type of card used.

The driver is now available and you can select the ControlNet port from Who Active in RSLogix 5000 programming software.

Connecting a SoftLogix Controller to ControlNet

The SoftLogix5800 controller is a 'soft control' solution that runs in a Microsoft Windows NT, Windows 2000, or Windows XP environment. When using this controller, you must install the SoftLogix5800 Chassis monitor–a virtual chassis that takes the place of hardware chassis used with other Logix5000 controllers.

Before you can connect the SoftLogix system to the ControlNet network, you must create the 1784-PCIC or 1784-PCICS card as part of the SoftLogix chassis.

IMPORTANT You can only use the 1784-PCIC or 1784-PCICS cards to connect a SoftLogix controller to ControlNet.

1. In the SoftLogix chassis monitor, create a New Module.

A. Click *Slot*

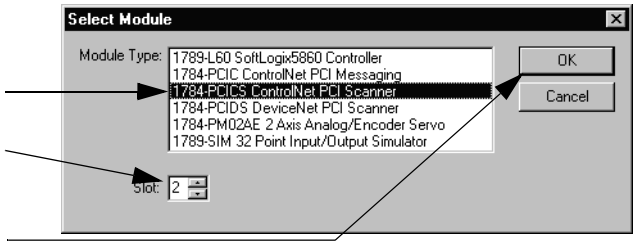
B. Click *Create Module*

2. Select the 1784-PCIC or 1784-PCICS card.

A. Select the ControlNet card.

B. Specify the virtual backplane slot number.

C. Click OK

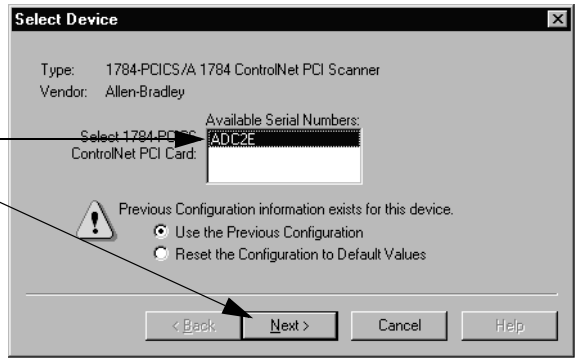


3. Select the serial number of the 1784-PCIC(S) card you want.

   If you previously configured the card that you selected by serial number, the chassis monitor remembers the configuration from the last time you used the card (whether in the same or different slot).

A. If multiple cards are located in your computer, choose the serial number of the correct one.

B. Click Next.

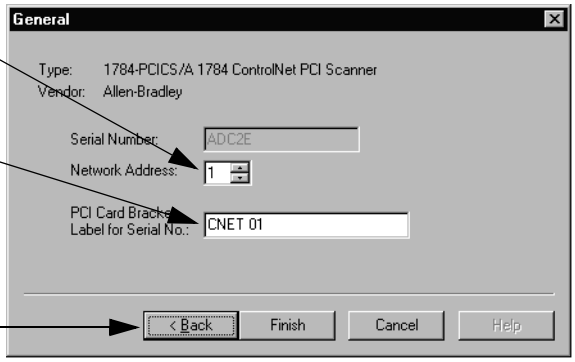


4. Configure the card.

A. Specify the node address on the ControlNet network

B. Enter the label name for the card (this is the name you wrote on the label of the card to help you identify the card from others in the same computer).

C. Click Finish



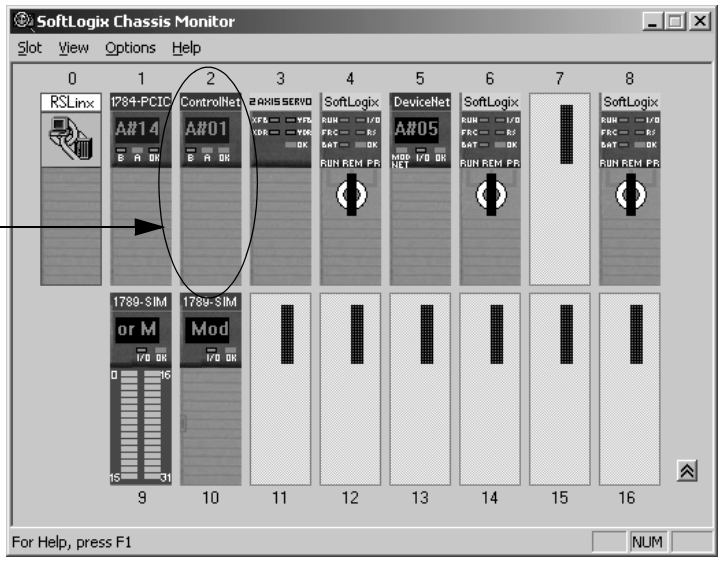
You can specify any slot number greater than 0 for the communication card. RSLinx software resides in slot 0.

By creating the card in the virtual chassis, you configure the communication driver information needed by the SoftLogix controller. **DO NOT** use RSLinx to install the ControlNet communication driver to the same card; installation through RSLinx adds the potential for conflicting configuration between RSLinx and the SoftLogix chassis monitor.

Instead, configure a Virtual Backplane driver in RSLinx. After you add the card to the chassis monitor and configure a Virtual Backplane driver, you can browse the network by expanding the Virtual Backplane driver and then expanding the port on the desired 1784-PCIC or 1784-PCICS communication card. Browsing ControlNet through the Virtual Backplane driver provides the same functionality as the RSLinx driver.

The chassis monitor shows the 1784-PCICS card as a virtual module in the SoftLogix chassis. The LEDs on the virtual monitor emulate a 1756-CNBR communication module.

This chassis monitor has a 1784-PCICS card installed in slot 2.



Configuring a ControlNet Module

Using This Chapter

Read this chapter for:

- *1756-CNB, 1756-CNBR modules*
- *1784-PCIC, 1784-PCICS cards*
- *1788-CNx cards*
- *1794-ACN15, -ACNR15 adapters*
- *1797-ACNR15 adapter*

This chapter describes how to configure a ControlNet communication module to operate on a ControlNet network.

IMPORTANT The example configuration process shown in this chapter uses a ControlLogix ControlNet Bridge module (1756-CNB) in a ControlLogix controller project. However, the overall configuration process (briefly described on page 3-2) generally applies to any of the ControlNet communication modules covered by this manual.

To configure a ControlNet communication module to operate on the ControlNet network, you must:

- Connect your computer to the RSLogix 5000 project via an RSLinx ControlNet communication driver
- Add the ControlNet communication module to your RSLogix 5000 project.
- Schedule the ControlNet network via RSNetWorx for ControlNet.

Connecting Your Computer to Connect to ControlNet

You connect your personal computer to the ControlNet network via an RSLinx ControlNet communications driver. You use the ControlNet communications driver to:

- upload and download controller projects using RSLogix 5000
- schedule the ControlNet network via RSNetWorx for ControlNet

For more information on how to connect a computer to the ControlNet network, see Chapter 2.

Using RSLogix 5000

Use RSLogix 5000 to configure the I/O tree in your project.

Overview of the RSLogix 5000 Configuration Process

When you use RSLogix 5000 to configure a ControlNet communication module, you must perform the following steps:

1. Add the new local module to your project; you must be offline.
2. Configure the local module, including:
   a. Naming the module
   b. Choosing a Communication Format
   c. Setting the Revision level
   d. Setting the module location as necessary (e.g. setting the slot number for a 1756-CNB module)
   e. Choosing an Electronic Keying method
3. Add the new remote module to your project.
4. Configure the remote module similarly to the local module.

IMPORTANT There are some differences between configuring a local ControlNet communication module and a remote ControlNet communication module. Those differences are covered later in this chapter.

5. Download configuration to the controller.

Add a Local ControlNet Module

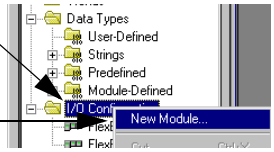
After you have started RSLogix 5000 and created a controller project, you can add ControlNet communication modules. A local ControlNet module is a module that resides in the same chassis as the controller.

IMPORTANT You must be offline when you create a new module.

1. If your application is online, go offline.
2. Select a New Module for the I/O Configuration.

A. Right-click on I/O Configuration.

B. Select New Module.



3. Select the module type from the Select Module Type pop-up. The example below uses a 1756-CNB module.

A. Select the local ControlNet communication module.

B. Click *OK*.

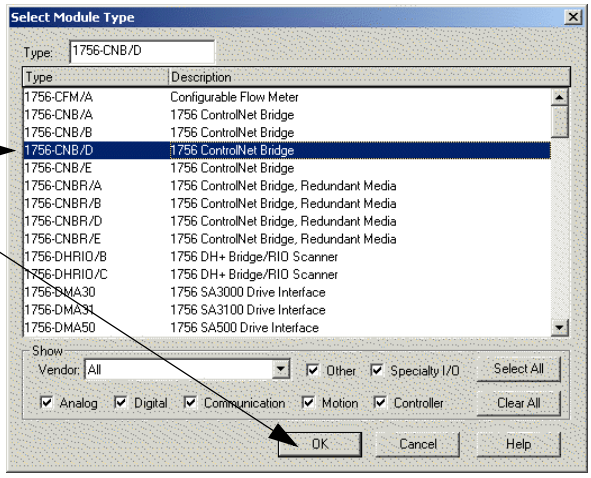


Table 3.1 lists the ControlNet communication modules available locally (i.e., in the local chassis, computer or controller) with each Logix5000 controller.

Table 3.1

If you are using this Logix5000 controller:	You can use this ControlNet communication module locally:
ControlLogix	1756-CNB, 1756-CNBR
FlexLogix	1788-CNC, 1788-CNCR, 1788-CNF, 1788-CNFR
SoftLogix	1784-PCIC, 1784-PCICS

4. Configure the local ControlNet communication module.

IMPORTANT The example below shows configuration for a 1756-CNB module. However, depending on module-type (e.g. 1756, 1784, 1788, 1794) there may be slight differences in how to configure a local ControlNet communication module. If you need help configuring a specific module, use online help in RSLogix 5000.

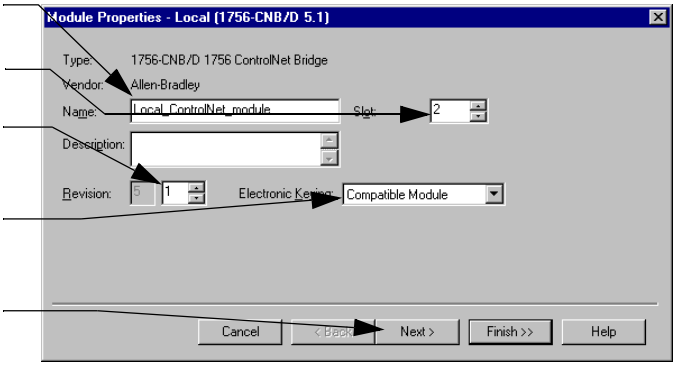
A. Name the module.

B. Select the module's slot number.

C. Select the module's minor revision level.

D. Select an Electronic Keying level. For more information on choosing a keying level, see Table 3.2 on page 3-5.

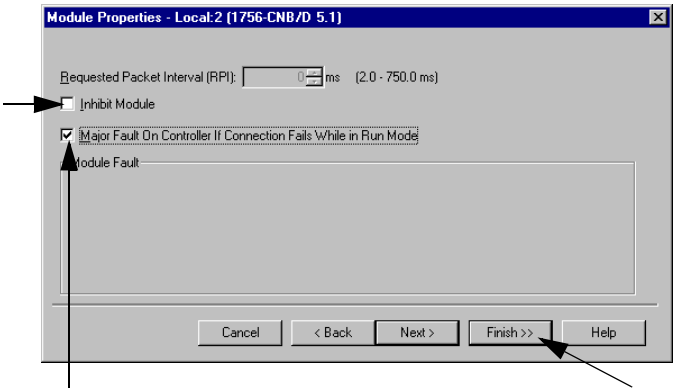
E. Click *Next*.



F. Inhibit the module, if necessary.

Initially, do you want the module to communicate with the controller?	Then:
Yes	Leave the box unchecked
No	Check the box(1)

(1) When you test this portion of the system, clear the check box.



G. Determine if you want a major fault on the controller if the connection to the local communication module fails in Run Mode.

If you want the controller to:	Then:
fault (major fault)	Select the check box
continue operating	Leave the check box unchecked(1)

(1) Monitor the connection using ladder logic.

F. Click *Finish*.

Table 3.2 describes the keying options available in RSLogix 5000.

Table 3.2 Electronic Keying Options

Keying option:	Definition:
Exact Match	When a controller establishes a connection with the ControlNet module, the following parameters must match or the inserted module will reject the connection: • Vendor • Product Type • Catalog Number • Major Revision • Minor Revision
Compatible Match	When a controller establishes a connection with the ControlNet module, the inserted module decides whether it is compatible with the parameters listed above. Generally, all except Minor Revision must match or it will reject the connection.
	TIP We recommend using Compatible Match whenever possible. However, keep in mind that modules can emulate older revisions and, with major revision changes, the module only works to the level of the configuration. If a slot is configured for a module with major.minor revision of 1.7 and you insert a module with a major.minor revision of 2.3, the module works at the 1.7 level, with respect to module functions that are related to RSLogix 5000 such as interface changes. However, bug fixes that are affected by the module's firmware, would work at the 2.3 revision level. If possible, we suggest you make sure configuration is updated to match the revision levels of all I/O modules. Failure to do so may not prevent the application from working but may defeat the purpose of upgrading your modules' revision levels.
Disable Keying	When a controller establishes a connection with the ControlNet module, the inserted module attempts to accept the connection regardless of its type.
	ATTENTION  Be extremely cautious when using the disable keying option; if used incorrectly, this option can lead to personal injury or death, property damage or economic loss.
	Even if keying is disabled, a controller will not establish a connection if the slot is configured for one module type (e.g. communication module) and a module of another type (e.g. output module) is inserted in the slot.

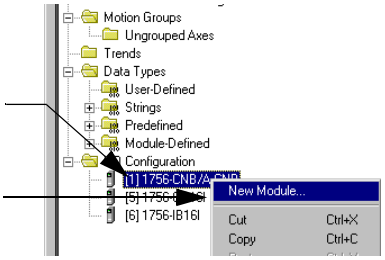
Add a Remote ControlNet Module

After you have added the local ControlNet communication module, you must add remote ControlNet communication modules. A remote ControlNet module is a module that resides in a separate chassis from the controller.

1. Select a New Module for the I/O Configuration.

A. Right-click on the local communication module.

B. Select New Module.

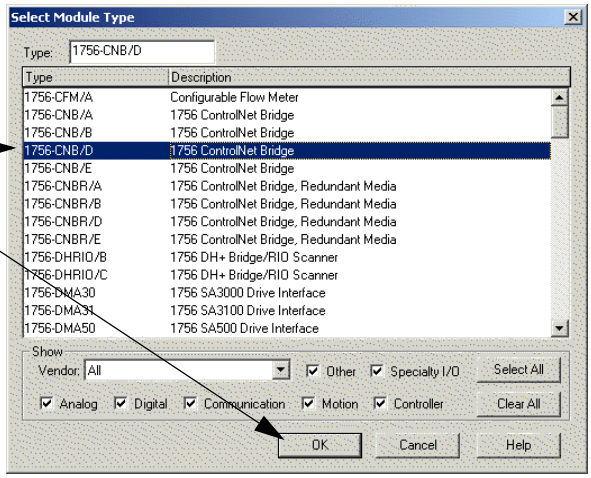


2. Select the module type from the Select Module Type pop-up.

   You can connect any remote ControlNet communication module, to a local ControlNet communication module.

A. Select the remote ControlNet communication module.

B. Click *OK*.



3. Configure the remote ControlNet communication module.

IMPORTANT The example below shows configuration for a 1756-CNB module. However, depending on the remote module-type (e.g. 1756, 1784, 1788, 1794) there are differences in how to configure a remote ControlNet communication module. If you need help configuring a specific module, use online help in RSLogix 5000.

A. Name the remote module.

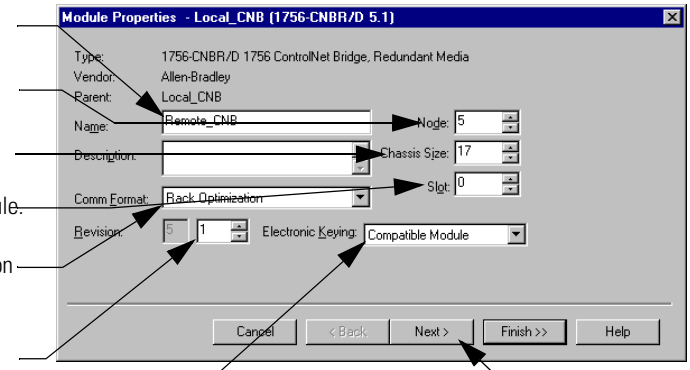
B. Select the remote module's *Node*.

C. Select the remote *Chassis Size*.

D. Select the *Slot* containing the remote module.

E. Select a Comm Format. For more information on choosing a Comm Format, see page 3-8.

F. Select the remote module's minor revision level.



G. Select an Electronic Keying level. For more information on choosing a keying level, see Table 3.2 on page 3-5.

H. Click *Next*.

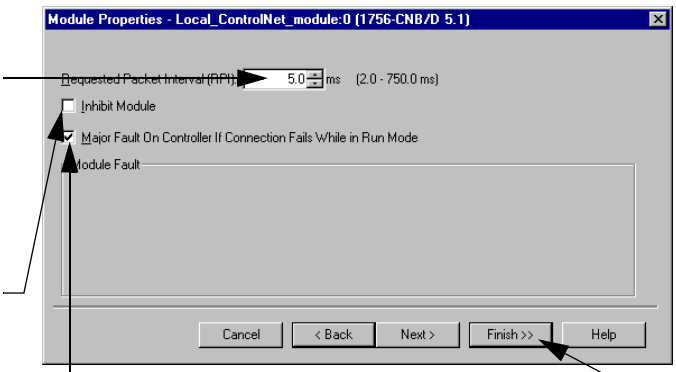
I. Set the RPI rate.

The RPI must be equal to or greater than the ControlNet Network Update Time (NUT). This parameter only applies if the module uses one of the Rack Optimized communication formats.

J. Inhibit the module, if necessary.

Initially, do you want the module to communicate with the controller?	Then:
Yes	Leave the box unchecked
No	Check the box[1]

[1] When you test this portion of the system, clear the check box.



K. Determine if you want a major fault on the controller if the connection to the PanelView fails in Run Mode.

L. Click *Finish*.

If you want the controller to:	Then:
fault (major fault)	Select the check box
continue operating	Leave the check box unchecked[1]

[1] Monitor the connection using ladder logic.

Communication Format

The communication format determines:

- what configuration options are available - for example, if the module uses *None*, then you do not have to configure an RPI rate on the next screen
- what type of data is transferred between the owner-controller and I/O connected via the communications module
- what tags are generated when configuration is complete
- the type of connection between the owner-controller and the I/O connected via the communication module

The communication format setting affects the Requested Packet Interval (RPI) rate on the next configuration screen. Table 3.3 lists the Comm Format choices

Table 3.3

<table>
<tr><th>This communication format choice:</th><th>Means:</th><th>And affects the RPI this way:</th></tr>
<tr><td>Rack Optimized</td><td>The communications module creates a rack "image" and returns I/O data in the rack image to the owner-controller.</td><td rowspan="2">You can specify an RPI that is:
equal to or greater than the NUT.
in the range allowed by RSLogix 5000 (i.e., 2 - 750ms)
When you set the RPI for a remote ControlNet communication module, we recommend you use a rate that is a power of two times the NUT.

For example, if your NUT = 5ms, we recommend the following RPI values:<table><tr><th>NUT = 5m</th><th>x 2^0</th><th>x 2^1</th><th>x 2^2</th><th>x 2^3</th><th>x 2^4</th></tr><tr><td>Optimal RPI values</td><td>5ms</td><td>10ms</td><td>20ms</td><td>40ms</td><td>80ms</td></tr></table></td></tr>
<tr><td>Listen-Only Rack Optimized - Choice is not available on all ControlNet communication modules.</td><td>The communications module creates a rack "image" and returns I/O input data in the rack image to the owner-controller.

The difference between this choice and Rack Optimized is that the I/O data in the rack image is returned to a controller that does not control the outputs but is only listening to its input data.</td></tr>
<tr><td>None</td><td>No RPI is required</td><td>The RPI box is grayed out.</td></tr>
</table>

Communication format does not apply to all ControlNet communication modules. For example, you do not choose a communication format when using the 1784-PCIC, 1784-PCICS nor 1788-CNx cards.

Download Configuration to the Logix5000 Controller

IMPORTANT Before you download configuration to your ControlNet Communication modules, consider whether you will schedule the ControlNet network offline or online.

- If you are going to schedule the network offline, complete the steps beginning on page 3-12 before downloading configuration.
- If you are going to schedule the network online, complete the steps beginning below and then move to page 3-17.

When you finish adding the local and remote ControlNet communication modules to your RSLogix 5000 project, you must download the new configuration to your Logix5000 controller.

1. Because you must schedule the ControlNet network (explained in the following section) before using the new configuration, switch your Logix5000 controller to Program mode in one of the following ways:
   - Turn the controller keyswitch to PROG
   - Turn the controller keyswitch to REM and use RSLogix 5000 to change the controller to Remote Program mode.
2. Use the Who Active button to begin the download process.

Click on the Who Active button.

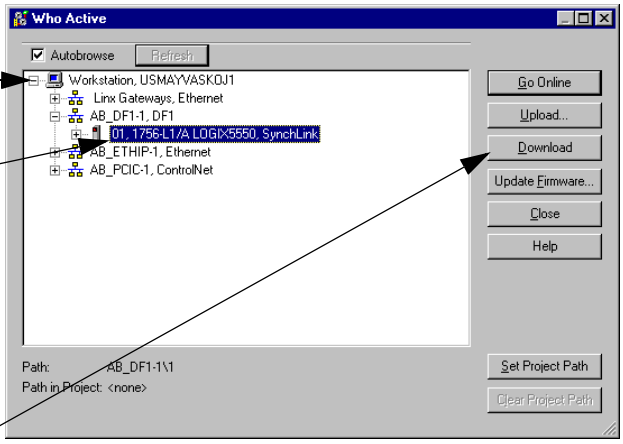
3. Use the Who Active pop-up screen to download configuration to the controller.

A. Expand the tree until you find the correct driver.

B. Select the controller to which you need to download configuration.

In this example, the Logix5550 controller is connected via an RS-232 DF1 device.

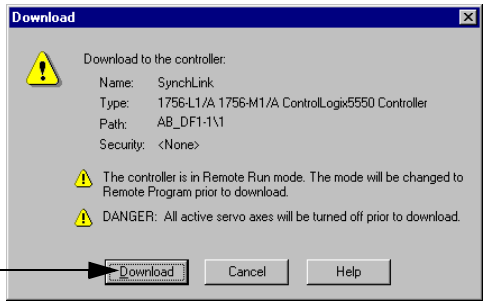
C. Click on Download.



The window above uses a previously configured driver for the communication path to the controller. In this example, the computer is connected to the controller's RS-232 port, so the configuration is downloaded to the controller via RS-232 and DF-1 protocol.

4. Download the configuration.

Click on Download.



Be aware, however, that before downloading configuration, RSLogix 5000 warns you of any implications the download has on your application.

Using RSNetWorx for ControlNet

You must use RSNetWorx for ControlNet to schedule the network before the configured I/O devices in your application will become active. You must also reschedule the network if a change is made to an existing network that was already scheduled.

Scheduling a ControlNet Network For the First Time

RSNetWorx stores information in keeper devices. The following ControlNet communication modules are keeper cable devices:

- 1756-CNB(R) modules
- 1784-PCICS card
- 1788-CNx cards
- PLC-5C module

If you configure a keeper on one network and then use it on another network, the conflicting information can make it difficult to use RSNetWorx to schedule the new network. In extreme cases it may be impossible to go online, more commonly you get many apparently irrelevant error messages about devices that existed on the old network but do not exist or are different on the new one.

- For more information on the network keeper, see page C-7.
- For more information on how to reset valid keepers to an unconfigured state to resolve mismatches, see the RSNetWorx online help.
- For more information on how to clear the memory (i.e., keeper information) in a ControlNet communication module, see the Knowledgebase at http://support.rockwellautomation.com.

You can schedule a ControlNet network either:

- offline

  or

- online.

These options are covered in the following sections.

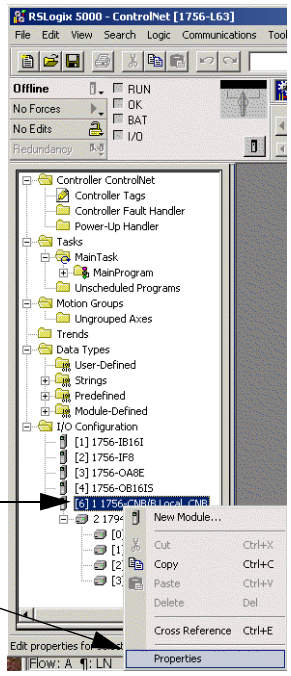
Schedule the Network Offline

The following instructions assume that:

- all keepers are unconfigured or do not conflict with the current network.
- your RSLogix 5000 project uses 1 controller and 1 network.
- your RSLogix 5000 project is complete but has not been downloaded to the controller.

If your network has already been scheduled and you made a change to it, you must reschedule it. See page 3-21.

1. In your RSLogix 5000 project, access the local ControlNet module's properties.



A. Right-click on the local ControlNet communication module.

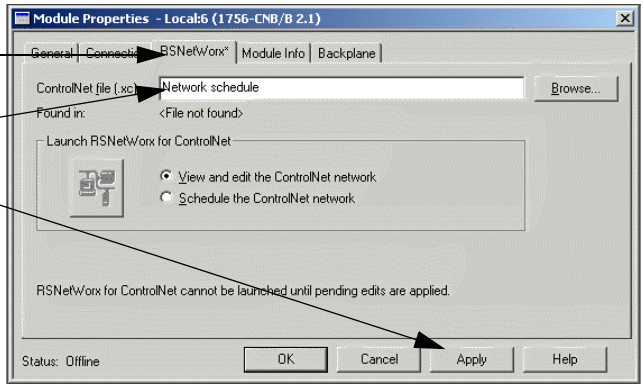
B. Click Properties.

2. On the RSNetWorx tab, name the new ControlNet file.

A. Click on the RSNetWorx tab.

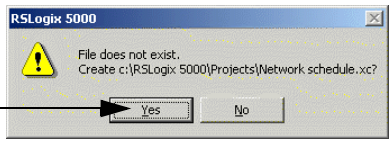
B. Type the name of the new ControlNet file.

C. Click *Apply*.



3. Because this is the first time you are scheduling the network, the file does not exist. When RSLogix 5000 prompts you to create the new file, click Yes.

Click Yes.

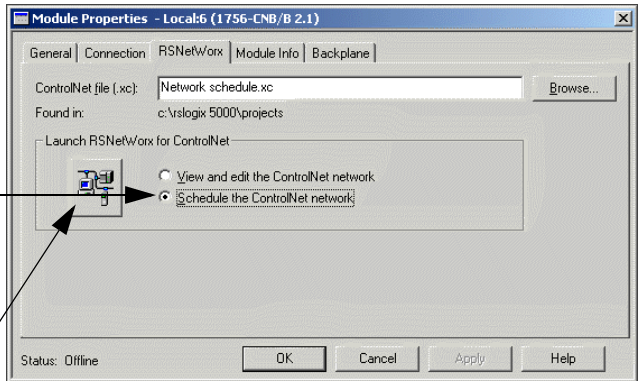


This step creates the file that RSNetWorx for ControlNet uses offline to browse and schedule network.

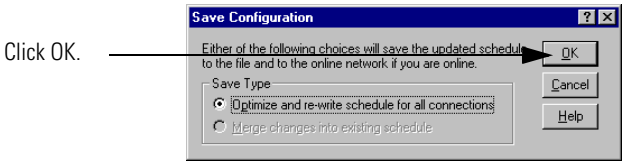
4. Launch RSNetWorx for ControlNet to create the schedule.

A. Click on Schedule the ControlNet network. If you make this selection, RSNetWorx will automatically enable edits, create the schedule and disable edits.

B. Click this button to launch RSNetWork for ControlNet.

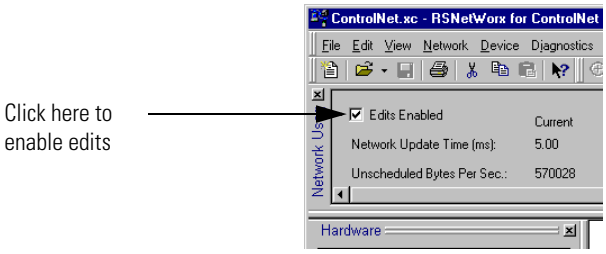


5. RSNetWorx for ControlNet starts and creates a schedule that includes the devices in your RSLogix 5000 project. When the software prompts you to Optimize and re-write schedule for all connections, click OK.



As described in step 4 on page 3-13, because you selected the Schedule the Network option, RSNetWorx for ControlNet automatically enables and disables edits before and after creating the schedule for the network respectively.

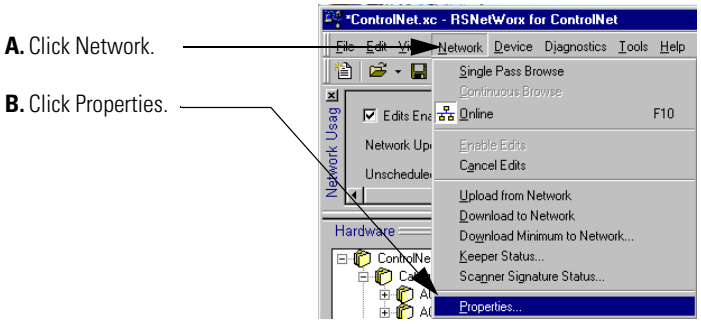
6. Enable Edits in the schedule.



TIP

We recommend that you return to RSLogix 5000 and save the project after you enable edits in RSNetWorx for ControlNet. Saving the file updates the network file in your RSLogix 5000 project.

7. To change the network properties from default settings to those that best fit your network, access the network properties.



8. Configure the network parameters as needed.

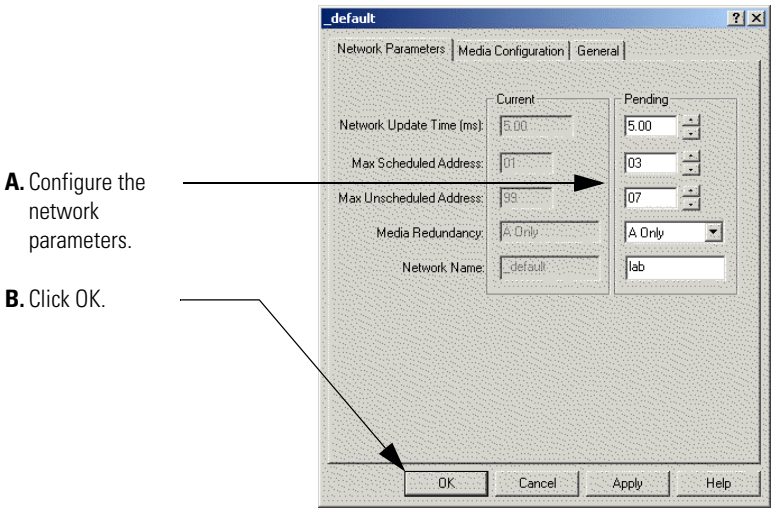


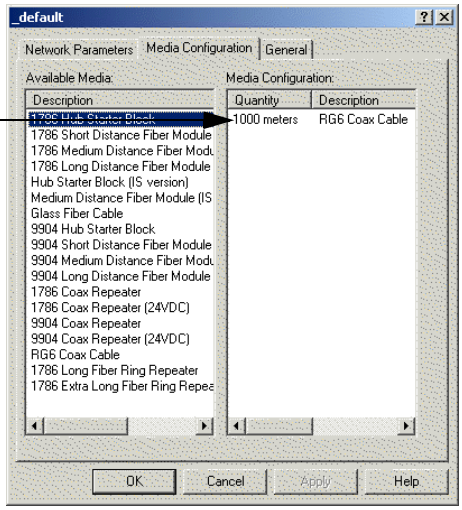
Table 3.4 describes the parameters used on this screen.

Table 3.4

Parameter:	Description:
Network Update Time (ms)	The smallest user-configurable repetitive time cycle in milliseconds at which data can be sent on ControlNet.
Max. Scheduled Address:	This is the node with the highest network address that can use scheduled time on a ControlNet link. I/O data is transferred during scheduled time.
Max. Unscheduled Address:	Node with the highest network address that can use unscheduled time on a ControlNet link. Messaging data is transferred during unscheduled time. Nodes set at addresses higher than the maximum unscheduled node do not communicate on the network (e.g., they will not display in RSLinx.)
Media Redundancy	Designates if the network uses media redundancy
Network Name	User-defined name of the network

9. If necessary, change the media configuration. The default media configuration is sufficient in most cases. However, adjust the configuration if your network is longer or uses repeaters. If the media configuration does not accurately represent the maximum propagation delay between any two nodes, your network may experience errors.

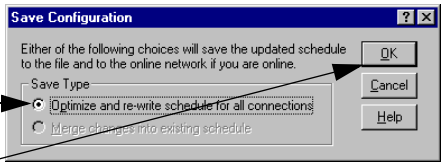
This example shows the default media configuration of 1000m of RG6 coaxial cable.



10. Save the file.

A. Select Optimize and re-write schedule for all connections.

B. Click OK.



11. Return to your RSLogix 5000 project to:

a. save the project again.

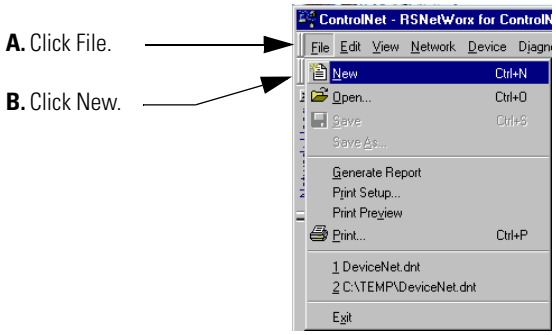
b. download configuration, as described on page 3-9.

Schedule the Network Online

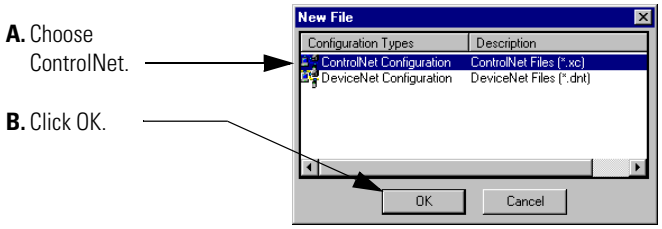
The following instructions assume that all keepers are unconfigured or do not conflict with the current network. If your network has already been scheduled and you made a change to it, you must reschedule it. See page 3-21.

1. Start RSNetWork for ControlNet.

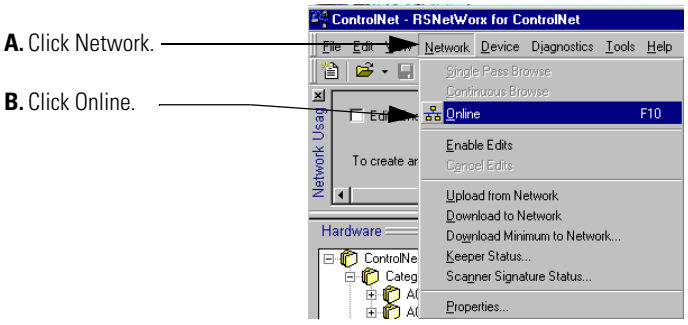
2. Start a new ControlNet file.



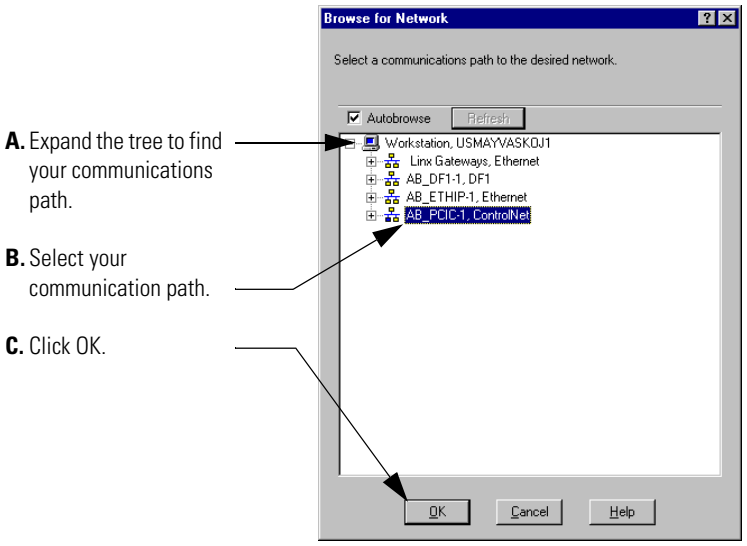
3. Choose a ControlNet configuration for the new file.



4. Go online.

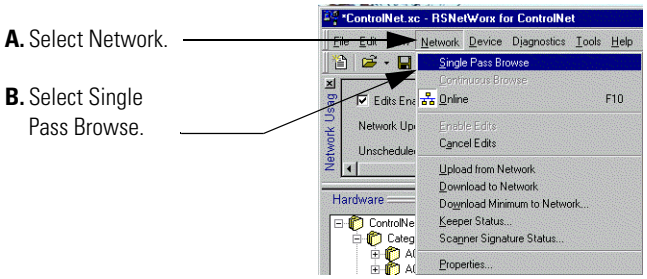


5. Select a communication path to the ControlNet network.

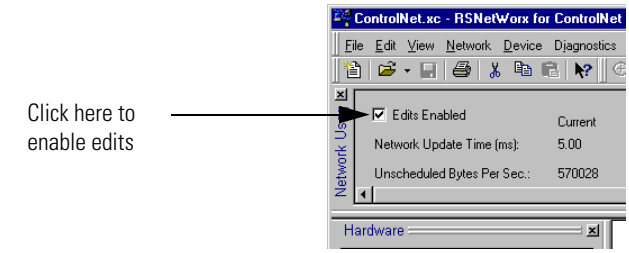


The window above uses a previously configured communication path to the controller. In this example, the computer is connected to the ControlNet network via a 1784-PCIC card. The driver was previously configured via RSLinx, as described in Chapter 2.

6. Set the network to Single Browse Pass.



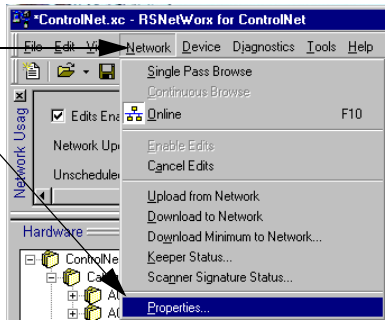
7. Enable edits on the file. When you enable edits, the RSNetWorx for ControlNet software reads data in the ControlNet modules and builds a schedule for the network.



8. Access the network properties.

A. Click Network.

B. Click Properties.



9. Configure the network parameters.

A. Configure the network parameters.

B. Click OK.

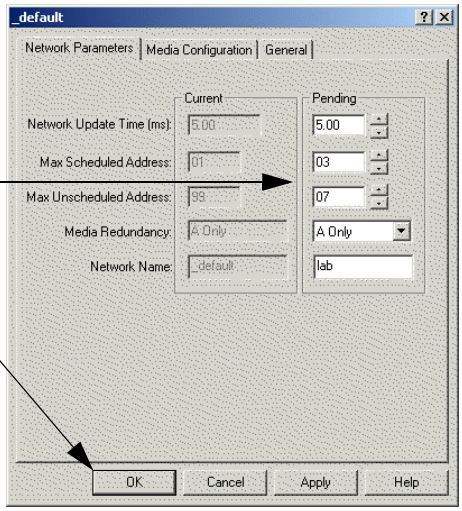


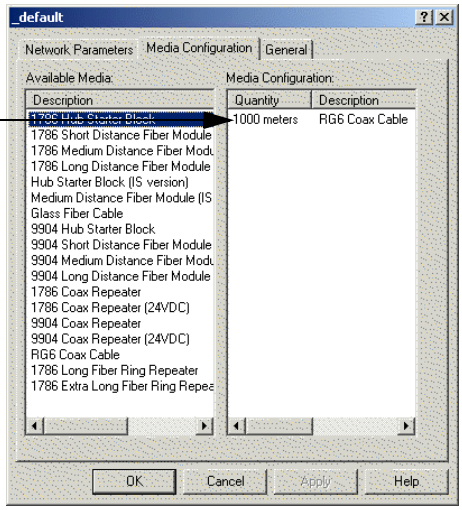
Table 3.5 describes the parameters used on this screen.

Table 3.5

Parameter:	Description:
Network Update Time (ms)	The smallest user-configurable repetitive time cycle in milliseconds at which data can be sent on ControlNet.
Max. Scheduled Address:	This is the node with the highest network address that can use scheduled time on a ControlNet link. I/O data is transferred during scheduled time.
Max. Unscheduled Address:	Node with the highest network address that can use unscheduled time on a ControlNet link. Messaging data is transferred during unscheduled time. Nodes set at addresses higher than the maximum unscheduled node do not communicate on the network (e.g., they will not display in RSLinx.)
Media Redundancy	Designates if the network uses media redundancy on any of the network communications modules.
Network Name	User-defined name of the network

10. If necessary, change the media configuration. The default media configuration is sufficient in most cases. However, adjust the configuration if your network is longer or uses repeaters. If the media configuration does not accurately represent the maximum propagation delay between any two nodes, your network may experience errors.

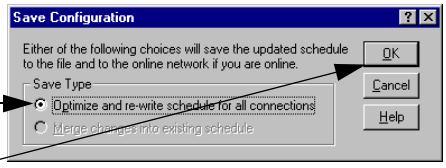
This example shows the default media configuration of 1000m of RG6 coaxial cable.



11. Save the file. This will schedule and activate the network.

A. Select Optimize and re-write schedule for all connections.

B. Click OK.



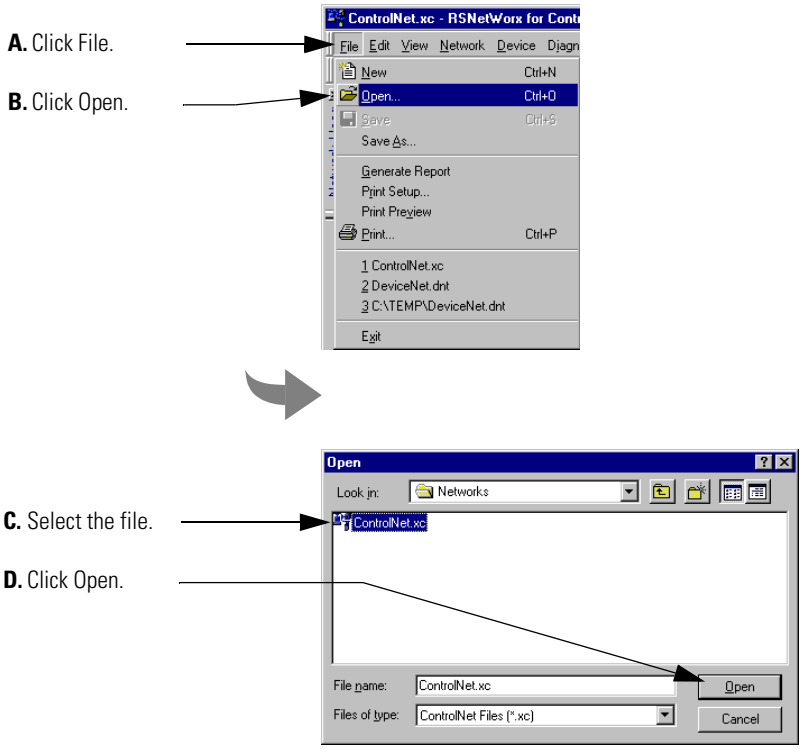
12. In RSLogix 5000, save the online project.

Rescheduling a ControlNet Network That Has Previously Been Scheduled

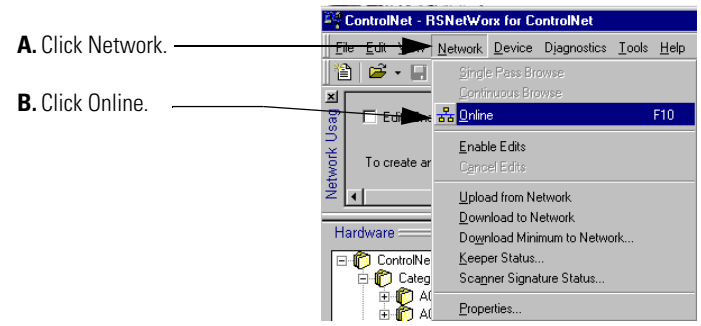
If you change a network that has already been scheduled, you must reschedule the network for the changes to take effect. For example, if you add I/O to an existing ControlNet network, you must reschedule the network for the I/O to become active.

1. Start RSNetWorx for ControlNet.

2. Open the ControlNet file that matches the existing network.

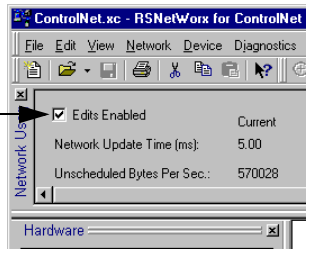


3. Go online.



4. Enable edits on the file. When you enable edits, the RSNetWorx for ControlNet software reads data in the ControlNet modules and builds a schedule for the network.

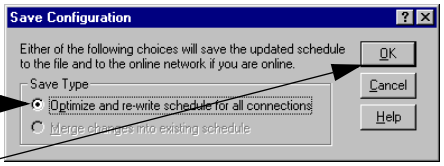
Click here to enable edits



5. Save the file. This will schedule and activate the network.

A. Select Optimize and re-write schedule for all connections.

B. Click OK.



IMPORTANT

It is always preferable to optimize connections. However, in some cases involving multiple controllers, the Merge changes... option is available. This option allows controllers whose connections have not changed to continue uninterrupted operation. When you merge changes into the existing schedule, those controllers whose connections have not changed remain in Run mode rather than changing to Program mode.

6. In RSLogix 5000, save the online project.

Controlling I/O

Using This Chapter

Read this chapter for:

- *1756-CNB, 1756-CNBR modules*
- *1784-PCICS card*
- *1788-CNx cards*
- *1794-ACN15, -ACNR15 adapters*
- *1797-ACNR15 adapter*

This chapter describes how a controller controls distributed I/O over ControlNet. The controller requires a communication module to connect to the network. Distributed I/O modules require an adapter to connect to the network.

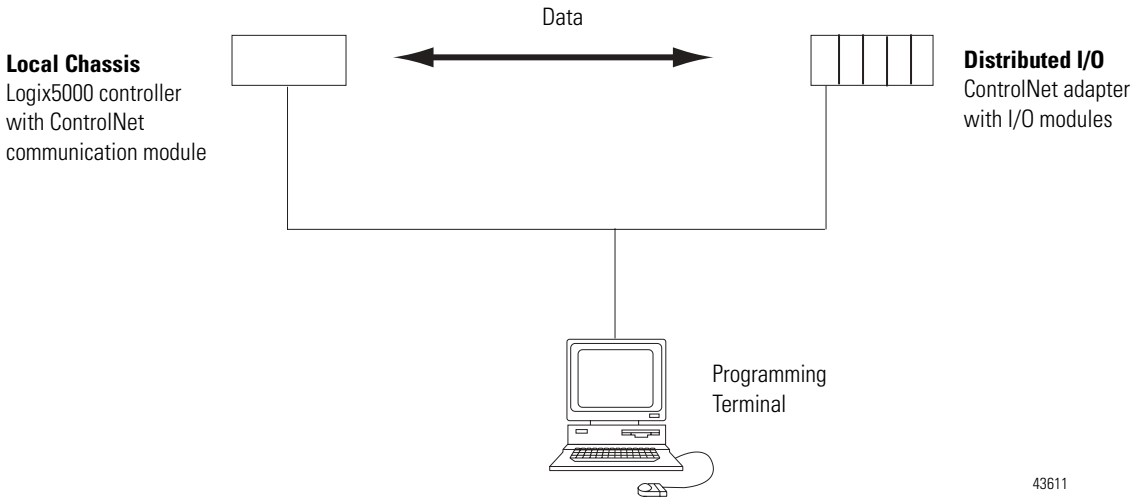
To control distributed I/O over ControlNet, you must:

- Add local and remote ControlNet communication modules to your RSLogix 5000 project.
- Add distributed I/O to your RSLogix 5000 project.
- Schedule the ControlNet network via RSNetWorx for ControlNet.
- Use the I/O information in RSLogix 5000

You can also validate connections to distributed I/O when controlling it over ControlNet. This task is particularly useful when one or more of the connections are not working but is not required, especially when all connections appear to work normally.

Set Up the Hardware

In this example, the Logix5000 controller uses a ControlNet communication module in the local chassis to connect to the ControlNet network. The distributed (remote) I/O has a ControlNet adapter to connect it to the ControlNet network.



Make sure:

- all wiring and cabling is properly connected
- the communication driver (such as, AB-PCICS-1) is configured for the programming workstation

Setting a Requested Packet Interval

When you configure an I/O module, you define the RPI for the module. The RPI specifies the period at which data updates over a connection. For example, an input module sends data to a controller at the RPI that you assign to the module. Configure the RPI in milliseconds.

RPIs are only used for modules that produce or consume data. For example a local ControlNet communication module does not require an RPI because it is not a data-producing member of the system; it is used only as a bridge.

In Logix5000 controllers, I/O values update at a period that you configure via the I/O configuration folder of the project. The values update asynchronously to the execution of logic. At the specified interval, the controller updates a value independently from the execution of logic.

Set the RPI only as fast as needed by the application. The RPI determines the number of packets per second on a connection. Each I/O module has a limit of how many packets it can handle per second. If you exceed this limit, the module cannot open any more connections.

Selecting a Communication Format

When you configure a remote ControlNet communications module or an I/O module, you select a communication format. The communication format you choose determines the data structure for the tags that are associated with the module. Many I/O modules support different formats. Each format uses a different data structure.

The communication format that you choose also determines:

- Direct or rack-optimized connection
- Ownership of outputs

For a remote ControlNet communications module, you must select one of the formats listed in Table 4.1

Table 4.1

Use this communication format with a remote ControlNet communication module:	In these scenarios:
None	• All of the remote I/O communicating with a controller via the remote ControlNet communication module use a Direct Connection communication format. • The connection is used for scheduled peer interlocking. • When I/O will be predominately direct connections. • When multiple controllers control the outputs in the chassis
Rack optimized	• Some or all of the remote I/O communicating with a controller via the remote ControlNet communication module use a Rack Optimized communication format. • To minimize ControlNet bandwidth when using large volume of digital I/O. • If only one controller will control the I/O.
Rack optimized - Listen only	• Some or all of the remote I/O communicating with a controller via the remote ControlNet communication module use a Rack Optimized communication format. • The connection is going to read inputs but is not going to be controlling outputs.

For I/O modules, the available communication formats depend on the module type. In general:

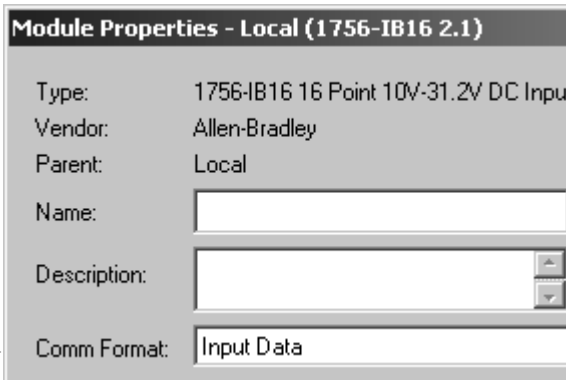
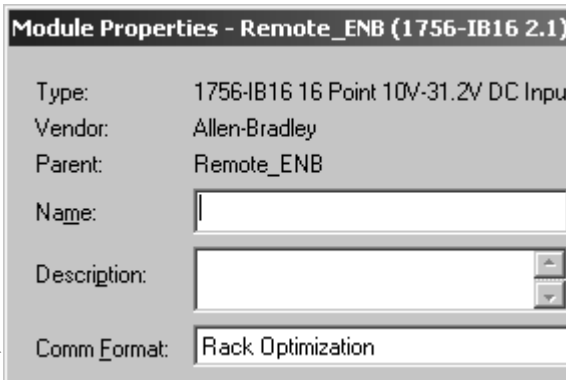
Table 4.2

If you have this type of I/O module:	And want:	Select a communication format that specifies:
digital module	a rack-optimized connection	Rack Optimization
	a direct connection or to use specialty features of the module, such as diagnostics, timestamps, or electronic fuses or to only listen to data from the module	The data your controller needs from the I/O module. For example, if your application uses a 1756-IA16I module in a remote chassis that must provide timestamped input data, you should select the CST Timestamped Input Data communication format. A Listen Only communication format that matches the data the I/O module is broadcasting to other controllers.
analog module	a direct connection or to use specialty features of the module, such as diagnostics, timestamps, or electronic fuses or to only listen to data from the module	The data your controller needs from the I/O module. For example, if your application uses a 1756-OF6CI module in a remote chassis that must provide floating point output data, you should select the Float Data communication format. A Listen Only communication format that matches the data the I/O module is broadcasting to other controllers.

See online help in RSLogix 5000 programming software for specific communication formats per I/O module.

Direct or rack-optimized connection

Logix5000 controllers use connections to transmit I/O data. These connections can be direct connections or rack-optimized connections.

This term:	Means:
direct connection	A direct connection is a real-time, data transfer link between the controller and an I/O module–analog or digital. In some cases (i.e., with some modules), this connection enables your controller to collect more data from an I/O module. For example, with a direct connection, the controller can collect diagnostic status data from a 1756-IA8D module that would not be collected in a rack-optimized connection. The controller maintains and monitors the connection with the I/O module. Any break in the connection, such as a module fault or the removal of a module while under power, sets fault bits in the data area associated with the module. A direct connection is any connection that *does not* use the Rack Optimization Comm Format. → 
rack-optimized connection	**Digital I/O modules only** – A rack-optimized connection consolidates connection usage between the controller and all the digital I/O modules in the chassis (or DIN rail). Rather than having individual, direct connections for each I/O module, there is one connection for the entire chassis (or DIN rail). Anytime a remote chassis houses I/O modules that use rack-optimized connections, the remote ControlNet communication module connecting these modules to their owner-controller must also use a rack-optimized connection. However, you can mix direct and rack-optimized connections to the same remote chassis. For example, if your remote chassis houses 6 digital I/O modules and your application requires that you use direct connections for 3 but rack-optimized connections for the other others, you can select direct connections for the 3 that require them and rack-optimized connections for the other 3. In this case, even though you must use a rack-optimized connection for the remote ControlNet communication module the owner-controller still makes direct connections with the 3 I/O modules that are configured as such. You can only make up to 5 rack-optimized connections to a single remote ControlNet communications module. rack-optimized connection → 

Direct connections for I/O modules

In this example, assume that each distributed I/O module is configured for a direct connection to the controller.

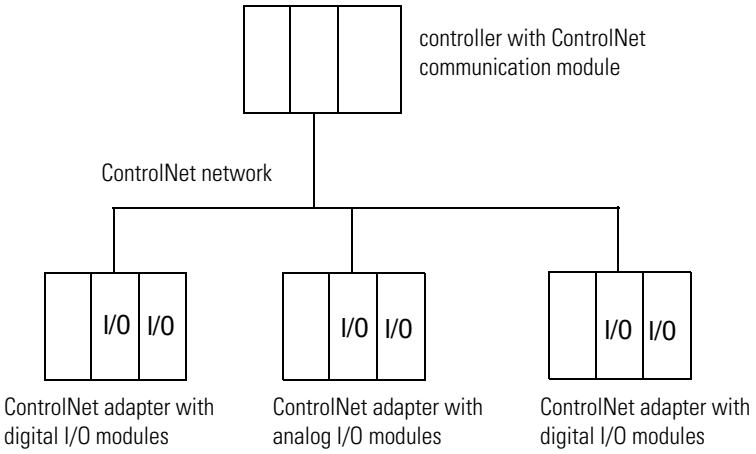


Table 4.3 calculates the connections in this example.

Table 4.3

System Connections:	Amount:
Controller to local ControlNet communication module	0
Controller to ControlNet adapter[1]	0
direct connection for digital I/O modules	4
direct connection for analog I/O modules	2
total connections used:	6

(1) In this example, the remote ControlNet adapter uses the *None* communications format.

TIP

If you have a high number of modules, direct connections to each module may not be feasible because the module supports a finite number of connections and packets per second, and direct connections may require more resources than the module has available.

In this case, use rack-optimized connections (see page 4-7) to conserve connection use and network traffic.

Rack-optimized connections for I/O modules

In this example, assume that each digital I/O module is configured for a rack-optimized connection to the controller. Analog modules must be configured for direct connections.

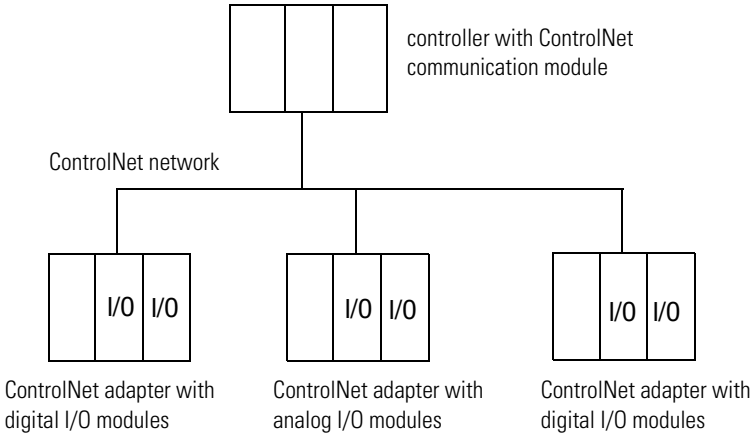


Table 4.4 calculates the connections in this example.

Table 4.4

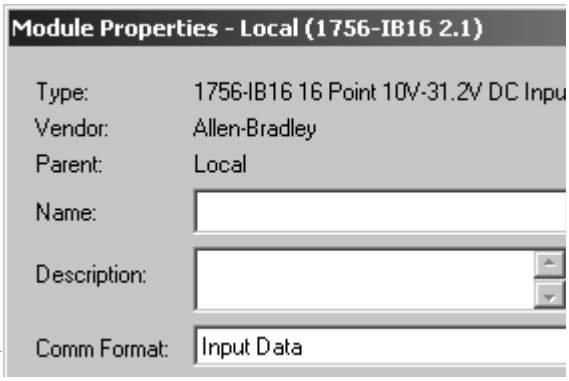
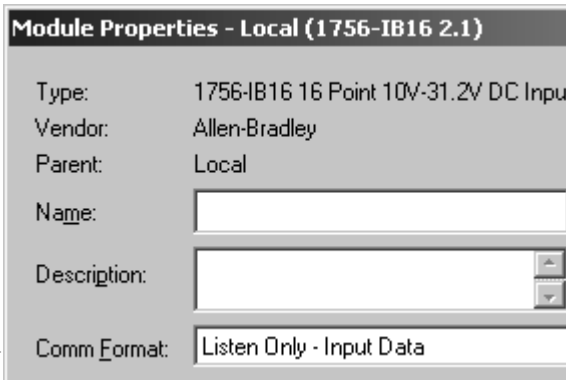
System Connections:	Amount:
Controller to local ControlNet communication module	0
Controller to ControlNet adapters with digital modules (rack-optimized connection to each adapter)	2
Controller to ControlNet adapter with analog modules (direct connection for each analog I/O module)	0 2
total connections used:	4

The rack-optimized connection conserves connections, but can limit the status and diagnostic information that is available from the digital I/O modules.

To increase the number of available connections, use a rack-optimized connection to any remote adapter with multiple digital I/O modules that allow rack-optimized connection, instead of direct connections to those I/O modules.

Ownership

In a Logix5000 system, modules multicast data. This means that multiple modules can receive the same data at the same time from a single module. When you choose a communication format, you have to choose whether to establish an owner or listen-only relationship with the module.

owner controller	The controller that creates the primary configuration and communication connection to a module. The owner controller writes configuration data and can establish a connection to the module. The owner controller is the only device that controls the outputs. An owner connection is any connection that *does not* include Listen-Only in its Comm Format. → 
listen-only connection	An I/O connection where another controller owns/provides the configuration data for the I/O module. A controller using a listen-only connection only monitors the module. It does not write configuration data and can only maintain a connection to the I/O module when the owner controller is actively controlling the I/O module. listen-only connection → 

Use Table 4.5 to choose the type of ownership for a module:

Table 4.5

If the module is an	And another controller:	And you want to:	Then use this type of connection:
input module	*does not* own the module	→	owner (i.e., *not* listen-only)
	owns the module	maintain communication with the module if it loses communication with the other controller	owner (i.e., *not* listen-only) Use the same configuration as the other owner controller.
		stop communication with the module if it loses communication with the other controller	listen-only
output module	*does not* own the module	→	owner (i.e., *not* listen-only)
	owns the module	→	listen-only

There is a noted difference in controlling input modules versus controlling output modules.

Table 4.6

Controlling:	This ownership:	Description:
input modules	owner	The controller that establishes an owner connection to an input module configures that module. This configuring controller is the first controller to establish an owner connection. Once a controller owns and configures an input module, other controllers can establish owner connections to that module. This allows additional owners to continue to receive multicasted data if the original owner-controller's connection to the module breaks. All other additional owners must have the identical configuration data and identical communications format that the original owner controller has, otherwise the connection attempt is rejected.
	listen-only	Once a controller owns and configures an input module, other controllers can establish a listen-only connection to that module. These controllers can receive multicast data while another controller owns the module. If all owner controllers break their connections to the input module, all controllers with listen-only connections no longer receive multicast data.
output modules	owner	The controller that establishes an owner connection to an output module configures that module. Only one owner connection is allowed for an output module. If another controller attempts to establish an owner connection, the connection attempt is rejected.
	listen-only	Once a controller owns and configures an output module, other controllers can establish listen-only connections to that module. These controllers can receive multicast data while another controller owns the module. If the owner controller breaks its connection to the output module, all controllers with listen-only connections no longer receive multicast data.

Adding Local and Remote ControlNet Modules

Before you can connect to and control distributed I/O, you must add local and remote ControlNet communication modules. The type of distributed I/O determines your choice of a remote ControlNet adapter. For more information, see Table 4.7.

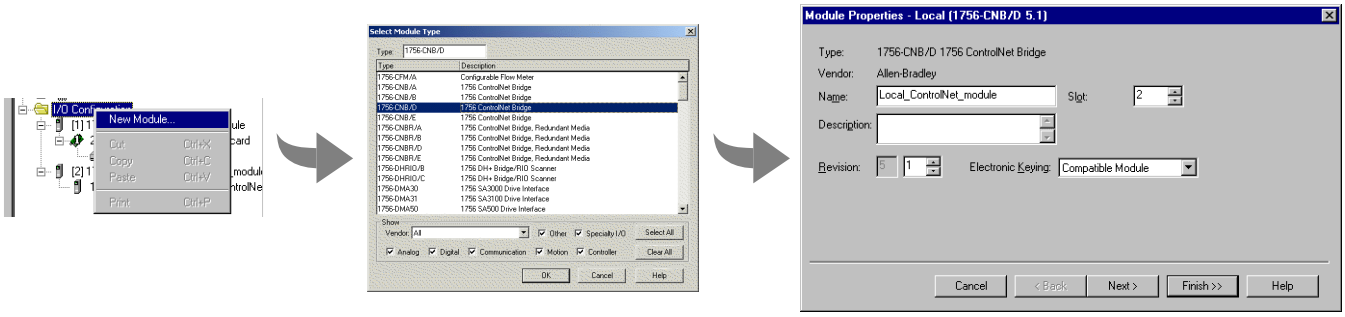
Table 4.7

If the distributed I/O is:	Select this remote adapter:	Which you configure via:
1756 ControlLogix I/O	1756-CNB, 1756-CNBR	RSLogix 5000
1794 FLEX I/O	1794-ACN15, 1794-ACNR15	
1797 FLEX Ex I/O	1797-ANCR	
1734 POINT I/O	1734-ACN	

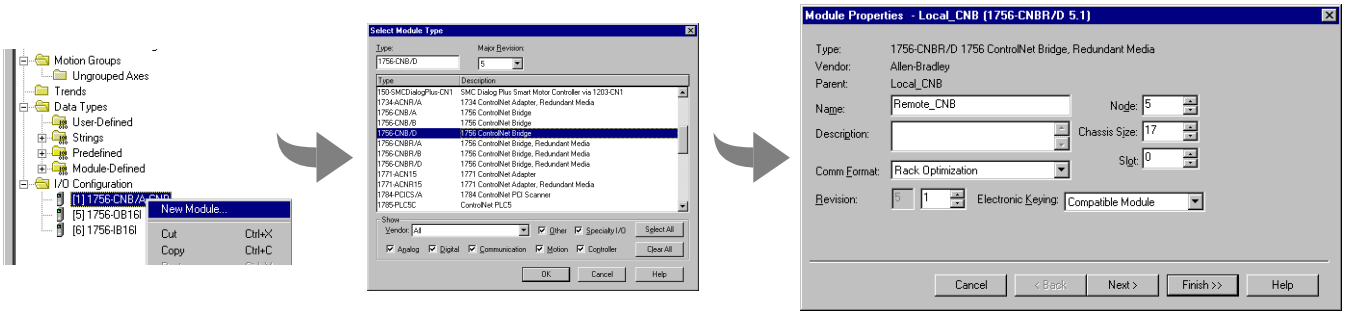
Figure 4.1 shows a brief series of screens used when adding local and remote ControlNet communication modules to an RSLogix 5000 project. For more detailed information on how to add local and remote ControlNet modules to your project, see Chapter 3.

Figure 4.1

1. Add Local ControlNet Communication Module



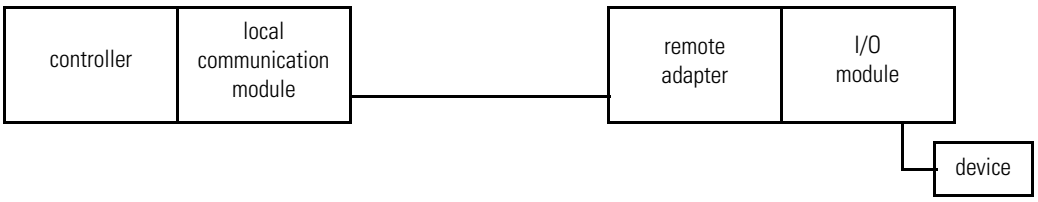
2. Add Remote ControlNet Communication Module



Adding Distributed I/O

To communicate with the I/O modules in your system, you add bridge, adapter, and I/O modules to the I/O Configuration folder of the controller. Within the I/O Configuration folder, you organize the modules into a hierarchy (tree/branch, parent/child).

For a typical distributed I/O network…

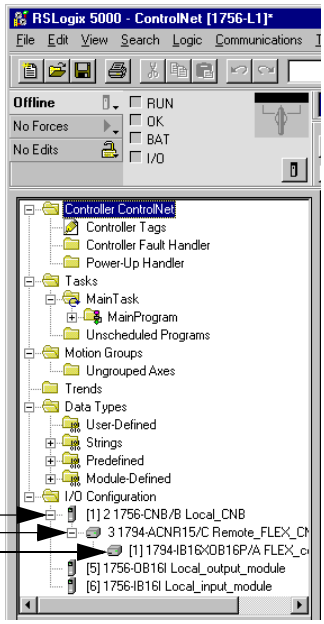


…you build the I/O configuration in this order

A. Add the local communication module (bridge).

B. Add the remote adapter for the distributed I/O chassis or DIN rail.

C. Add the distributed I/O module.



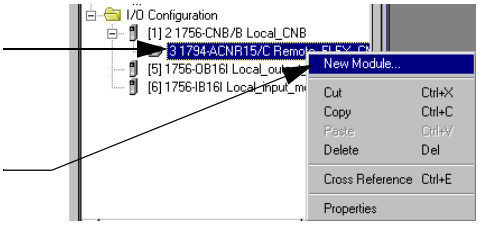
Do these steps to add distributed I/O to your RSLogix 5000 project:

1. Add the local and remote ControlNet communications modules as described on page 4-10 or in Chapter 3.

2. Add the distributed I/O module.

A. Right-click on the remote ControlNet communication module.

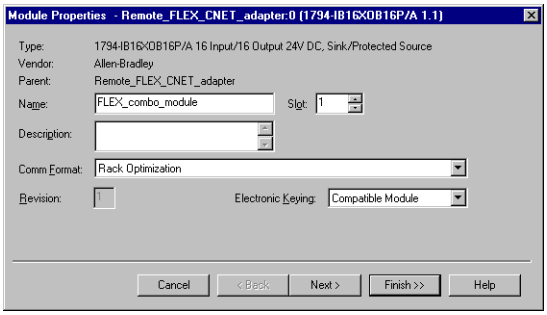
B. Click *New Module*.

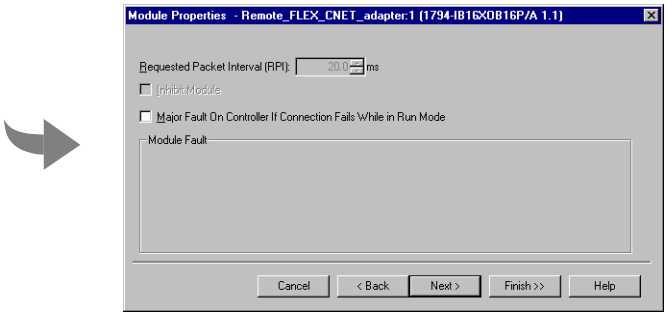


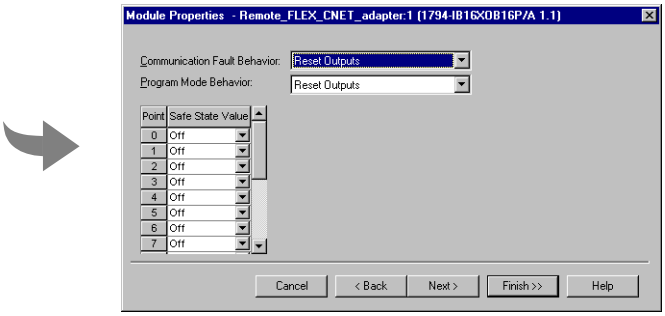
3. Configure the distributed I/O module. Depending on the distributed I/O type, the configuration screens differ. The example below shows screen for a 1794-IB16XOB16P/A digital combo module.

   For more information on configuring distributed I/O modules over ControlNet, see the modules' individual technical documentation and the RSLogix 5000 online help.

To:	Do this:
Use the module's default configuration.	Specify the general information about the module (name, comm format, RPI etc.) and click *Finish*.
Customize the configuration.	Specify the general information about the module (name, comm format, RPI etc.). Then use the *Next* buttons to step through subsequent screens to configure such parameters as filter times and fault actions.







The Comm Format selection you make when you add distributed I/O modules is based on whether you want rack-optimized or direct connections to each distributed I/O module. In general:

Table 4.8

If you select this format for the remote adapter:	Select this format for the distributed I/O module:
Rack Optimization	*Rack Optimization*
None	*an appropriate direct-connection format*

Accessing Distributed I/O

I/O information is presented as a structure of multiple fields that depend on the specific features of the I/O module. The name of the structure is based on the location of the I/O module in the system. Each I/O tag is automatically created when you configure the I/O module in RSLogix 5000. Each tag name follows this format:

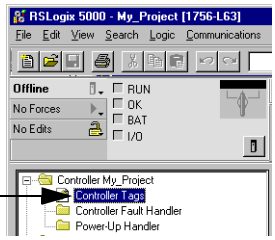
Location:SlotNumber:Type.MemberName.SubMemberName.Bit

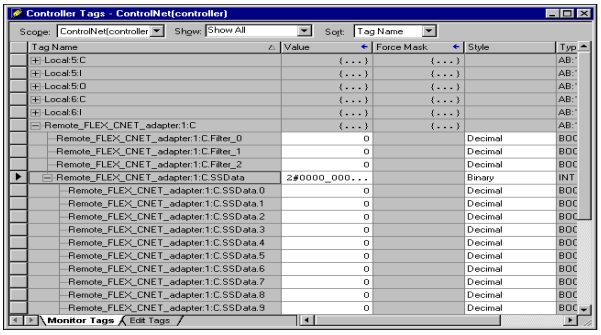
where:

This address variable:	Is:
Location	Identifies network location LOCAL = local DIN rail or chassis *ADAPTER_NAME* = identifies remote adapter or bridge that you specify
SlotNumber	Slot number of I/O module location in its chassis
Type	Type of data I = input O = output C = configuration S = status
MemberName	Specific data from the I/O module; depends on the type of data the module can store. For example, Data and Fault are possible fields of data for an I/O module. Data is the common name for values that are sent to or received from I/O points.
SubMemberName	Specific data related to a MemberName.
Bit (optional)	Specific point on the I/O module; depends on the size of the I/O module (0-31 for a 32-point module)

I/O information is available in the Controller Tags portion of your RSLogix 5000 project. You can monitor or edit the tags. The example screens below show how to access the Controller Tags and some sample tags.

Double-click on the Controller Tags portion of your RSLogix 5000 project.





The screen above contains a tag named:

Remote_FLEX_CNET_adapter:1:C.Filter_0

where:

This address variable:	Is:
Location	Remote_FLEX_CNET_adapter
SlotNumber	1
Type	Configuration
MemberName	Filter_0

The example below shows an I/O tree configured with a remote FLEX I/O adapter and four remote FLEX I/O modules.

EXAMPLE

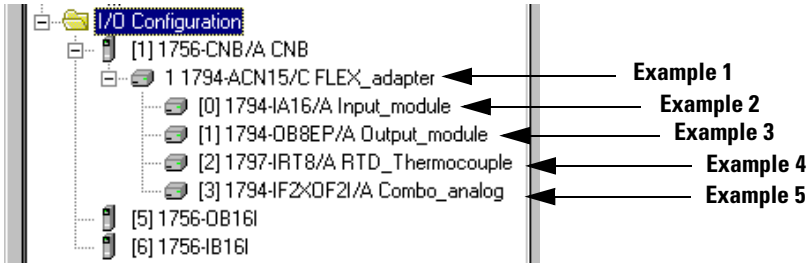


Table 4.9 describes some of the tag names that appear for these modules. The tags listed are not a complete list of the tags created for each module type. For a full list of the tags created for each module when configured as shown the second column, see the tag monitor/editor portion of RSLogix 5000.

Table 4.9

Example:	Module:	Example Tag Names (automatically created by the software):
Example 1	remote 1794-ACN15 adapter "FLEX_adapter"	FLEX_adapter:I FLEX_adapter:I.SlotStatusBits FLEX_adapter:I.Data FLEX_adapter:O FLEX_adapter:O.Data
Example 2	remote 1794-IA16 "Input_module" in slot 0 rack-optimized connection	FLEX_adapter:0:C FLEX_adapter:0:C.Config FLEX_adapter:0:C.DelayTime_0 FLEX_adapter:0:I
Example 3	remote 1794-OB8EP "Output_module" in slot 1 rack-optimized connection	FLEX_adapter:1:C FLEX_adapter:1:C.SSData FLEX_adapter:1:O FLEX_adapter:1:O

Table 4.9

Example:	Module:	Example Tag Names (automatically created by the software):
Example 4	remote 1794-IRT8 "RTD_thermocouple" in slot 2 direct connection	FLEX_adapter:2:C FLEX_adapter:2:C.Config1 FLEX_adapter:2:C.FilterCutoff0 FLEX_adapter:2:C.ReferenceJunction3 FLEX_adapter:2:C.FaultMode_0_3 FLEX_adapter:2:C.DataFormat11 FLEX_adapter:2:I FLEX_adapter:2:I.Fault FLEX_adapter:2:I.Ch0Data FLEX_adapter:2:I.Alarms
Example 4	remote 1794-IF2XOF2I "Combo_analog" in slot 3 direct connection	FLEX_adapter:3:C FLEX_adapter:3:C.InputFilter FLEX_adapter:3:C.RTSInterval FLEX_adapter:3:C.Ch0InputCalibrate FLEX_adapter:3:I FLEX_adapter:3:I.Fault FLEX_adapter:3:I.RealTimeSample FLEX_adapter:3:O FLEX_adapter:3:O.SafeStateConfig0 FLEX_adapter:3:O.OutputEnable FLEX_adapter:3:O.Ch0OutputData

Validating Connections

Verify that the controller can communicate with the devices that you have just configured. Do these steps:

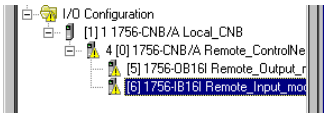
1. Determine if communications are established with the devices.

   a. If a ⚠ is NOT over the I/O Configuration folder, the controller can communicate with the device. Connections are valid.

   b. If a ⚠ is over the I/O Configuration folder, the controller cannot communicate with the device. Go to step 2.

2. Identify any faults.

   Start looking for faults at the communication module and work down through the tree. In the example screen below, faults occurred at the remote 1756-CNB module and the I/O modules added below it.

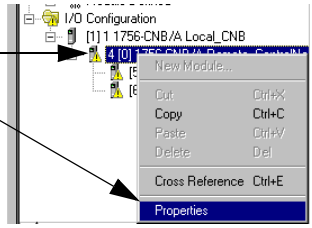


3. Identify the fault code.

If multiple faults appear on the screen, as shown above, identify the fault at the module that is highest in the I/O tree.

A. Right-click on the fault module.

B. Click Properties.

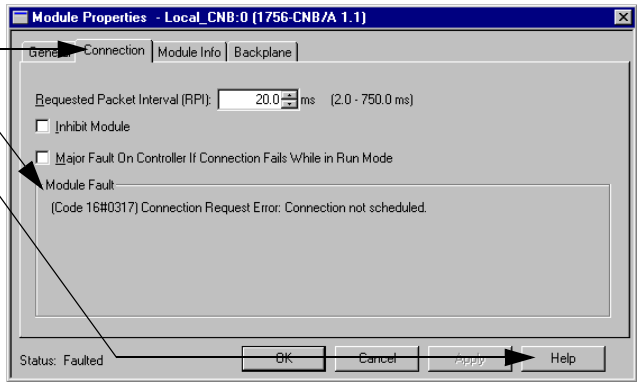


C. Click on the Connection tab.

D. Identify the code for the fault.

E. Use the Help button to access the online help and determine what the fault codes mean.

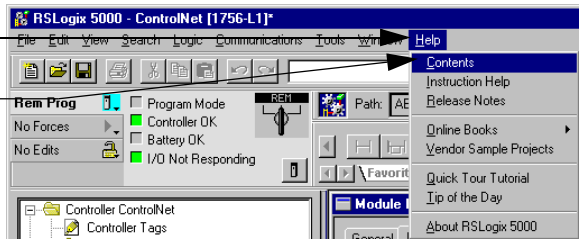
For more information on fault codes, see step 4 on page 4-19.



4. If necessary, get the definition of the fault code from the online help.

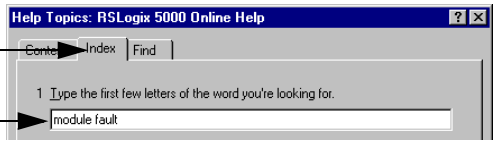
A. Click Help.

B. Click Contents



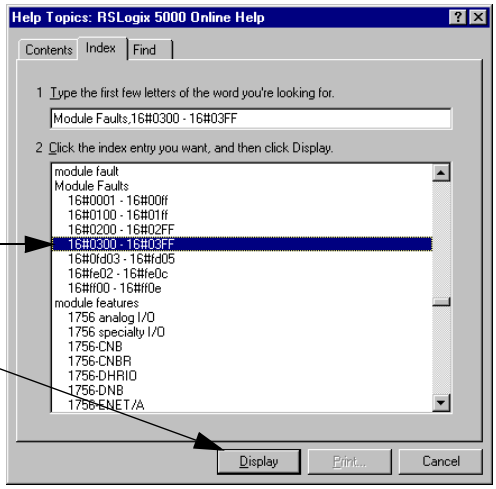
C. Click on the Index tab.

D. Type *module faults*.



E. When the list of module fault codes appears, select the range for the code you just identified.

F. Click Display.



5. Follow the recommendations for your fault code.

6. Return to step 1.

Notes:

Interlocking Controllers (Produce and Consume Tags)

Using This Chapter

Read this chapter for:

- *1756-CNB, 1756-CNBR modules*
- *1784-PCICS card*
- *1788-CNx cards*

This chapter describes how to interlock (produce and consume tags) controllers via a ControlNet network.

Interlocking controllers is a method of sharing scheduled data between controllers. Methods of communicating with other controllers are listed below:

If the data:	Then:	See:
needs regular, fast delivery at an interval that you specify	Produce and consume a tag	this chapter
is sent when a specific condition occurs in your application	Execute a message (MSG) instruction	Chapter 6

Terminology

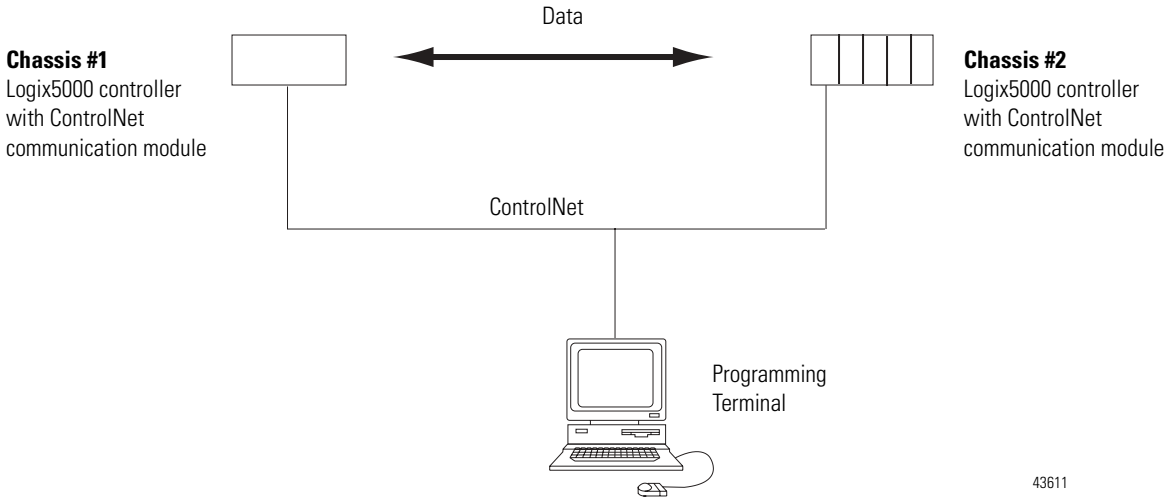
A Logix5000 controller lets you produce (broadcast) and consume (receive) system-shared tags.

Term:	Definition
produced tag	A tag that a controller makes available for use by other controllers. Multiple controllers can simultaneously consume (receive) the data. A produced tag sends its data to one or more consumed tags (consumers) without using logic. The produced tag sends its data at the RPI of the consuming tag.
consumed tag	A tag that receives the data of a produced tag. The data type of the consumed tag must match the data type (including any array dimensions) of the produced tag. The RPI of the consumed tag determines the period at which the data updates.

For two controllers to share produced or consumed tags, both controllers must be attached to the same ControlNet network.

Set Up the Hardware

In this example, the controller in the first chassis produces a tag that is consumed by the controller in the second chassis.



The Logix5000 controller in the first chassis and in the second chassis can be any of the following, with their ControlNet communication modules:

- 1756 ControlLogix controller with a 1756-CNB or 1756-CNBR communication module in the chassis
- 1789 SoftLogix controller with a 1784-PCICS communication card
- 1794 FlexLogix controller with a 1788-CNx ControlNet communication card
- PowerFlex 700S with DriveLogix controller and a 1788-CNx ControlNet communication card

Make sure that:

- the ControlNet communication modules are connected to a scheduled ControlNet network
- all wiring and cabling is properly connected
- the communication driver (such as., AB-PCICS-1) is configured for the programming workstation

TIP If you are sharing tags between ControlLogix controllers and the controllers are only sharing tags (i.e., not controlling any I/O modules), you can set the communication format of the 1756-CNB or 1756-CNBR module to None. This reduces connection usage and network traffic.

Determining Connections for Produced and Consumed Tags

Logix controllers can produce (broadcast) and consume (receive) system-shared tags that are sent and received via the ControlNet communication module. Produced and consumed tags each require connections.

This type of tag:	Requires these connections:
produced	The produced tag requires two connections. The producing controller must have one connection for the produced tag and the first consumer and one more connection for each additional consumer (heartbeat). The heartbeat is a small scheduled packet the consumer sends to indicate that it is getting the produced data. As you increase the number of controllers that can consume a produced tag, you also reduce the number of connections the controller has available for other operations, like communications and I/O.
consumed	Each consumed tag requires one connection for the controller that is consuming the tag.

All ControlNet modules support at least 32 connections. Additionally, the total number of tags that can be produced or consumed is limited by the number of available connections. If the communication module uses all of its connections for I/O and other communication modules, no connections are left for produced and consumed tags.

Each produced or consumed tag uses the following number of connections:

This controller:	And this type of tag:	Uses this many connections	This controller has this many available connections:
ControlLogix	produced tag	number of consumers + 1	250[1]
SoftLogix5800	consumed tag	1	250[2]
FlexLogix	produced tag	number of consumers	100[3]
PowerFlex 700S with DriveLogix	consumed tag	1	100[4]

(1) While the ControlLogix controller supports 250 connections, the 1756-CNB and 1756-CNBR modules are limited to 64 total connections (scheduled and unscheduled). We recommend you do not use more than 40 scheduled connections. You need multiple 1756-CNB(R) modules to reach the controller's 250 connection limit.

(2) While the SoftLogix5800 controller supports 250 connections, the 1784-PCICS card is limited to 127 scheduled connections. You need multiple 1784-PCICS cards to reach the controller's 250 connection limit.

(3) While the FlexLogix controllers support 100 connections, the 1788-CNx cards are limited to 32 connections (22 of which can be scheduled) each. Because the FlexLogix controller can only house 2 ControlNet communication cards, your controller can only make up to 64 connections (44 of which can be scheduled).

(4) While PowerFlex 700S with DriveLogix controllers support 100 connections, the 1788-CNx cards are limited to 32 connections (22 of which can be scheduled) each. Because the PowerFlex 700S with DriveLogix controller can only house 1 ControlNet communication card, your controller can only make up to 32 connections (22 of which can be scheduled).

Organizing Tags for Produced or Consumed Data

As you organize your tags for produced or consumed data (shared data), follow these guidelines:

<table>
<tr><th>Guideline:</th><th colspan="4">Details:</th></tr>
<tr><td>Create the tags at the controller scope.</td><td colspan="4">You can produce and consume only controller-scoped tags.</td></tr>
<tr><td>Use one of these data types:
• DINT
• REAL
• array of DINTs or REALs
• user-defined</td><td colspan="4">• To share other data types, create a user-defined data type that contains the required data.
• Use the same data type for the produced tag and corresponding consumed tag or tags.</td></tr>
<tr><td rowspan="5">To share tags with a PLC-5C controller, use a user-defined data type.</td><td>To:</td><td>This:</td><td colspan="2">Then:</td></tr>
<tr><td rowspan="3">produce</td><td>integers</td><td colspan="2">Create a user-defined data type that contains an array of INTs with an even number of elements, such as INT[2]. (When you produce INTs, you must produce two or more.)</td></tr>
<tr><td>only one REAL value</td><td colspan="2">Use the REAL data type.</td></tr>
<tr><td>more than one REAL value</td><td colspan="2">Create a user-defined data type that contains an array of REALs.</td></tr>
<tr><td>consume</td><td>integers</td><td colspan="2">Create a user-defined data type that contains the following members:
Data type: | Description:
DINT | Status
INT[x], where x is the output size of the data from the PLC-5C controller. (If you are consuming only one INT, omit x.) | Data produced by a PLC-5C controller</td></tr>
<tr><td>Limit the size of the tag to ≤480 bytes.</td><td colspan="4">If you must transfer more than 480 bytes, create logic to transfer the data in smaller packets or create multiple produce/consume tags.</td></tr>
<tr><td>Use the highest permissible RPI for your application.</td><td colspan="4">If the controller consumes the tag over a ControlNet network, use a binary multiple of the ControlNet network update time (NUT). For example, if the NUT is 5 ms, use an RPI of 5, 10, 20, 40 ms, etc.</td></tr>
<tr><td>Combine data that goes to the same controller.</td><td colspan="4">If you are producing several tags for the same controller:
• Group the data into one or more user-defined data types. (This uses less connections than producing each tag separately.)
• Group the data according to similar update intervals. (To conserve network bandwidth, use a greater RPI for less critical data.)
For example, you could create one tag for data that is critical and another tag for data that is not as critical.</td></tr>
</table>

Adjusting for Bandwidth Limitations

When you share a tag over a ControlNet network, the tag must fit within the bandwidth of the network:

- As the number of connections over a ControlNet network increases, several connections, including produced or consumed tags, may need to share a network update time (NUT).
- A ControlNet node can transmit approximately 500 bytes of scheduled data in a single NUT.

Depending on the size of your system, you may not have enough bandwidth on your ControlNet network for large tags. If a tag is too large for your ControlNet network, make one or more of the following adjustments:

<table>
<tr><th>Adjustment:</th><th>Description:</th></tr>
<tr><td>Increase the requested packet interval (RPI) of your connections – Recommended method</td><td>At higher RPIs, connections can take turns sending data during an update period.</td></tr>
<tr><td>Reduce your network update time (NUT).</td><td>At a faster NUT, less connections have to share an update period.</td></tr>
<tr><td rowspan="4">For a ControlNet bridge module (CNB) in a remote chassis, select the most efficient communication format for that chassis:</td><td>Are most of the modules in the chassis non-diagnostic, digital I/O modules? | Then select this communication format for the remote CNB module:</td></tr>
<tr><td>Yes | Rack Optimization</td></tr>
<tr><td>No | None</td></tr>
<tr><td>The Rack Optimization format uses an additional 8 bytes for each slot in its chassis. Analog modules or modules that are sending or getting diagnostic, fuse, timestamp, or schedule data require direct connections and cannot take advantage of the rack optimized form. Selecting “None” frees up the 8 bytes per slot for other uses, such as produced or consumed tags.</td></tr>
<tr><td>Separate the tag into two or more smaller tags.</td><td>1. Group the data according to similar update rates. For example, you could create one tag for data that is critical and another tag for data that is not as critical.
2. Assign a different RPI to each tag.</td></tr>
<tr><td>Create logic to transfer the data in smaller sections (packets).</td><td>For information on how to do this, see the Logix5000 Controllers Common Procedures Programming Manual, publication 1756-PM001.</td></tr>
</table>

Producing a Tag

A Logix5000 controller can only produce user-created tags in the local controller's tag structure. The Logix5000 controllers cannot produce I/O tags or tags aliased to I/O tags.

Follow the steps below to produce a tag:

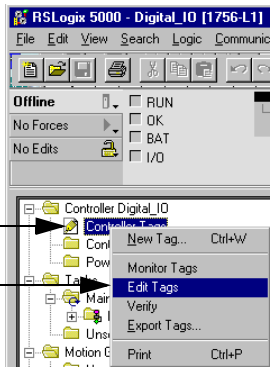
1. Open the RSLogix 5000 project that contains the tag that you want to produce.

IMPORTANT You can only create produced tags when your RSLogix 5000 project is offline.

2. Access the edit tab of the controller tags.

A. Right-click on Controller Tags.

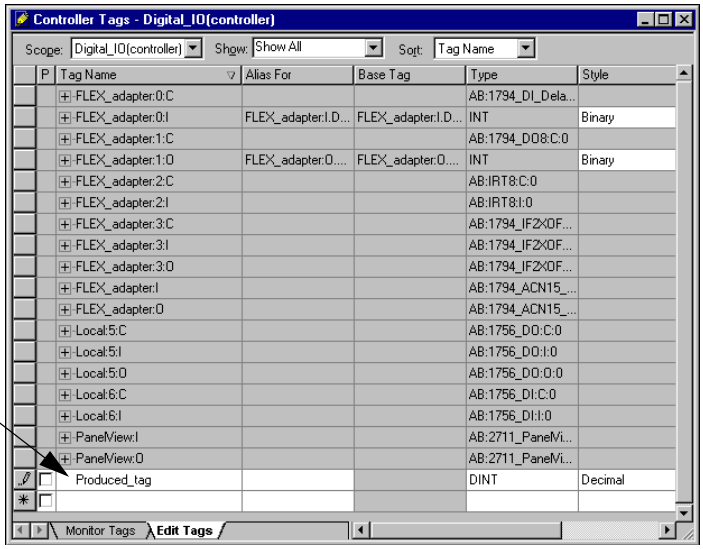
B. Click on Edit Tags.



3. Create the tag you want to produce.

A. Type the name of the new tag in an available Tag Name field.

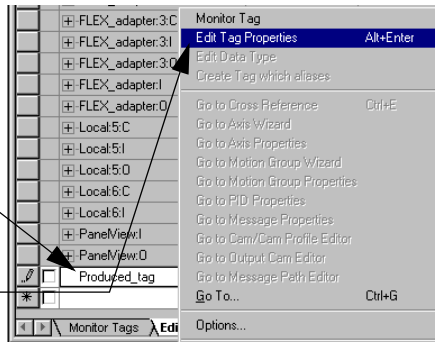
B. Press the *Enter* key.



4. Access the tag properties.

A. Right-click on the new tag name.

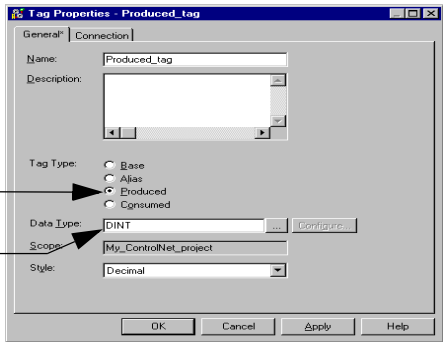
B. Click on Edit Tag Properties.



5. Change the tag properties as needed.

A. Choose the Produced Tag Type.

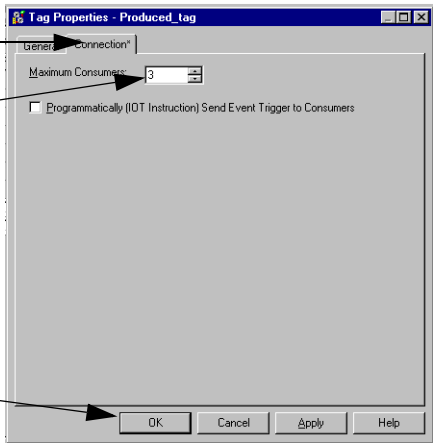
B. Make sure the Data Type is one that the controller can produce (e.g. a controller cannot produce a tag using the INT Data Type).



C. Click on the Connection tab.

D. Adjust the number of consumers. If you are unsure of the number of consumers, you can use a number higher than the actual number of consumers. However, unused connections are deducted from the number of connections your controller has available.

E. Click OK.



Consuming a Tag

Logix5000 controllers can only consume user-created tags from another controller's tag structure. The Logix5000 controllers cannot consume I/O tags or tags aliased to I/O tags.

Follow the steps below to consume a tag:

IMPORTANT You can only create consumed tags when your RSLogix 5000 project is offline.

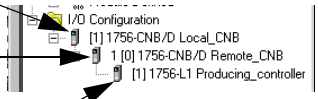
1. Open the RSLogix 5000 project that contains the controller that you want to consume the produced tag.

2. Make the sure the controller producing the tag to be consumed is in the consuming controller's I/O configuration, as shown in the example below.

Local ControlNet module in consuming controller's chassis

Remote ControlNet module

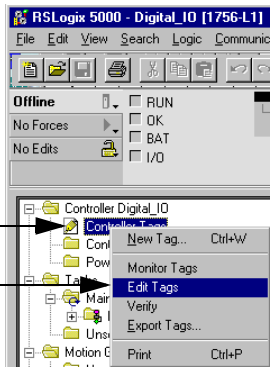
Producing controller



3. Access the edit tab of the controller tags.

A. Right-click on Controller Tags.

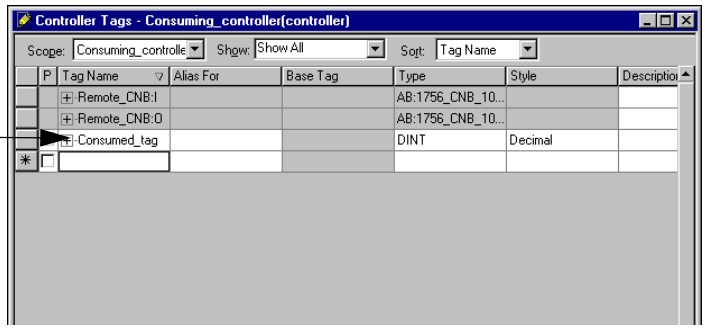
B. Click on Edit Tags.



4. Create the tag you want to consume.

A. Type the name of the new tag in an available Tag Name field.

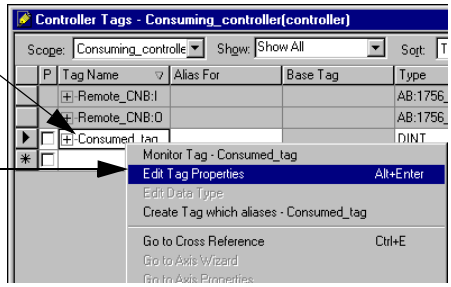
B. Press the *Enter* key.



5. Access the tag properties.

A. Right-click on the new tag name.

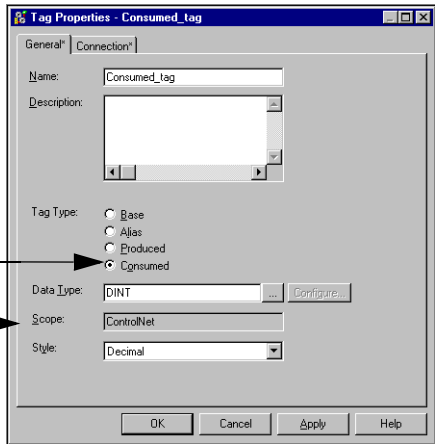
B. Click on Edit Tag Properties.



6. Change the tag properties as needed.

A. Choose the Consumed Tag Type.

B. Make sure the Data Type and Data Style matches the Type and Style in the tag created in step 5 on page 5-7.



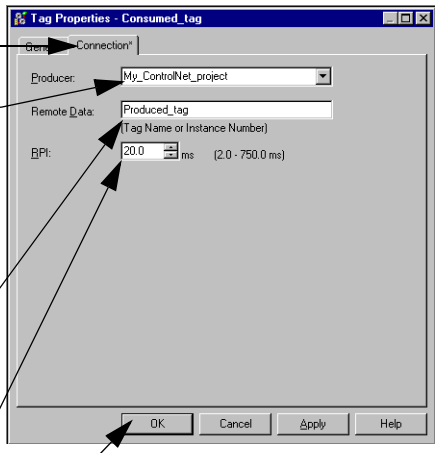
C. Click on the Connection tab.

D. Choose the Producer (i.e., the producing controller) from the pull-down menu. The menu contains all possible paths to previously configured controllers in the I/O tree.

E. Type in the name of the produced tag in the producing controller.

F. Set the RPI. The consuming controller determines the rate at which the tag is produced.

G. Click OK.



7. Use RSNetWorx for ControlNet software to schedule the network.

Additional Steps for a PLC-5 Controller

If you are sharing data with a PLC-5C controller, perform the following additional actions:

<table>
<tr><th>Action:</th><th colspan="3">Details:</th></tr>
<tr><td rowspan="4">In the ControlNet configuration of the PLC-5C controller, scheduled a message.</td><td>If the PLC-5C:</td><td>This:</td><td>Then in RSNetWorx software:</td></tr>
<tr><td>produces</td><td>integers</td><td>In the ControlNet configuration of the PLC-5C controller:

A. Insert a target for connections.

B. Send Data Message making the Produce Buffer in the PLC-5C equal to the Logix5000 controller's consume tag remote data (i.e., tag name or remote instance number).</td></tr>
<tr><td rowspan="2">consumes</td><td>DINTs</td><td>In the ControlNet configuration of the PLC-5C controller, under the desired Logix5000 controller:

A. Insert a Receive Data from Connection.

B. Type in the desired Logix5000 controller produced tag name in the value column.

C. In the Input size, enter two times the number of DINTs you need to read from produced tag. For example, if the produced tag contains 10 DINTs, enter 20 for the Input size; the Input size must be an even number.</td></tr>
<tr><td>REALs</td><td>In the ControlNet configuration of the PLC-5C controller, under the desired Logix5000 controller:

A. Insert a Receive Data from Connection.

B. Type in the desired Logix5000 controller produced tag name in the value column.

C. In the Input size, enter two times the number of REALs you need to read from produced tag. For example, if the produced tag contains 10 REALs, enter 20 for the Input size; the Input size must be an even number.</td></tr>
<tr><td>If the PLC-5C controller consumes REALs, reconstruct the values.</td><td colspan="3">When your Logix5000 controller produces REALs (32-bit floating-point values) to a PLC-5C controller, the PLC-5C consumes the data in consecutive 16-bit integers:

• The first integer contains the upper (left-most) bits of the value.
• The second integer contains the lower (right-most) bits of the value.
• This pattern continues for each floating-point value.

See the example on page 5-11.</td></tr>
</table>

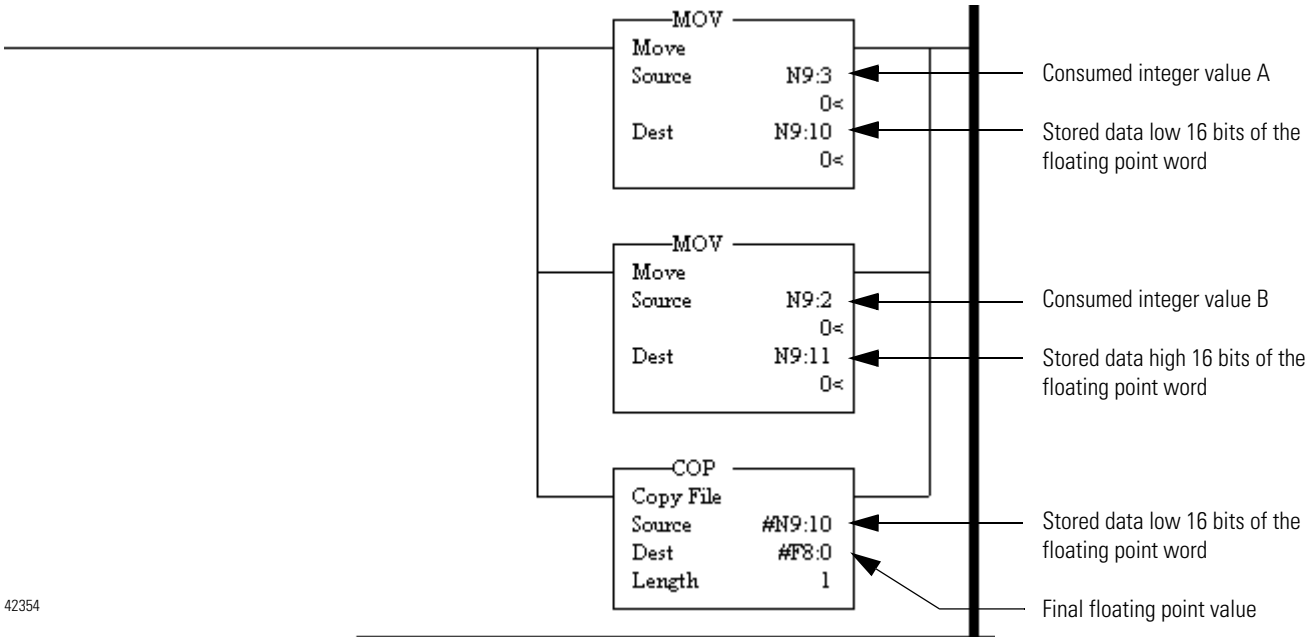
The following example shows how to re-construct a REAL (floating point value) in the PLC-5C controller

EXAMPLE

Re-construct a floating point value. This example takes two consumed integers that were originally a produced REAL, reverses the order of the integers and assembles them into a floating point value equal to the original REAL.

The two MOV instructions reverse the order of the integers and move them to a new location. Because the destination of the COP instruction is a floating-point address, it takes two consecutive integers, for a total of 32 bits, and converts them to a single floating-point value.

The length of a COP instruction is always multiplied by the size of the destination data type, so one in this example means one times the size of REAL (i.e., 32 bits). COP uses as many consecutive elements from the source file as necessary to satisfy this.



Peer-to-Peer Messaging

Using This Chapter

Read this chapter for:

- *1756-CNB, 1756-CNBR modules*
- *1784-PCIC, 1784-PCICS cards*
- *1788-CNx cards*

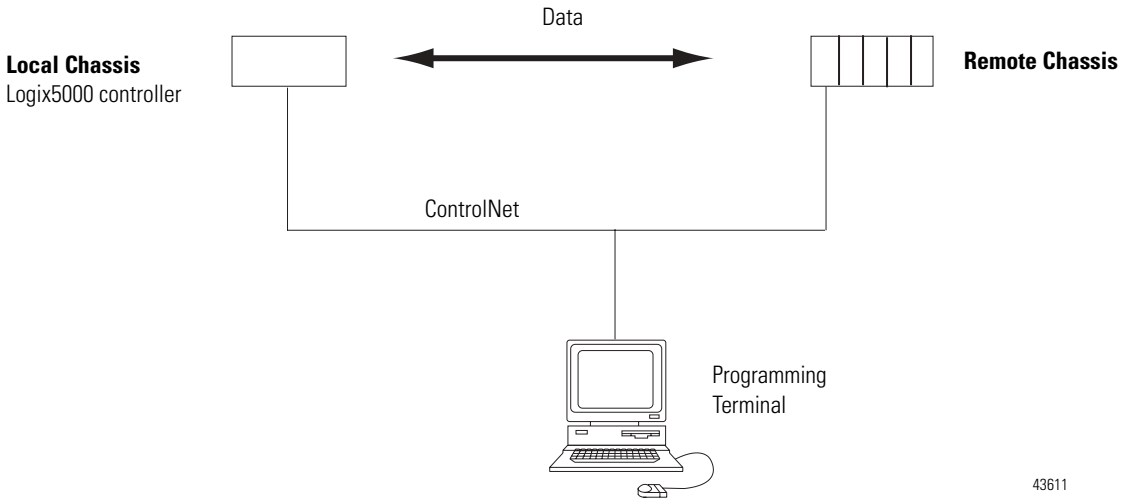
This chapter describes how to use MSG instructions to send data to and receive data from other modules on a ControlNet network.

There are different methods of communicating with other controllers:

If the data:	Then:	See:
needs regular, fast delivery at an interval that you specify	Produce and consume a tag	Chapter 5
• is sent when a specific condition occurs in your application • is sent at a slower rate than required by produced and consumed tags • is sent to devices that only communicate with unscheduled data	Execute a message (MSG) instruction	this chapter

Set Up the Hardware

In this example, the controller in the local chassis sends a message (using a MSG instruction) to another module (which can be a controller) on the ControlNet network.



The Logix5000 controller in the local chassis can be any of the following, with its ControlNet communication module:

- 1756 ControlLogix controller with a 1756-CNB or 1756-CNBR communication module in the chassis
- 1789 SoftLogix controller with a 1784-PCIC or 1784-PCICS communication card
- 1794 FlexLogix controller with a 1788-CNx ControlNet communication card
- PowerFlex 700S with DriveLogix controller and a 1788-CNx ControlNet communication card

The destination for the message can be any of the following:

- PLCs, SLCs or Logix5000 controllers on ControlNet or other networks
- I/O modules (e.g. ControlLogix analog module configuration data) on ControlNet or other networks
- 1771 block transfer modules

Make sure that:

- the ControlNet communication modules are connected to a ControlNet network
- all wiring and cabling is properly connected
- the communication driver (such as, AB-PCICS-1) is configured for the programming workstation

Guidelines for MSG Instructions

Follow these guidelines:

Guideline:	Details:
1. For each MSG instruction, create a control tag.	Each MSG instruction requires its own control tag. This tag contains control elements for messages (e.g., .DN and .EN), error codes and information to execute the message such as destination path and number of words to transfer. • Data type = MESSAGE • Scope = controller • The tag *cannot* be part of an array or a user-defined data type.
2. Keep the source and/or destination data at the controller scope.	A MSG instruction can access only tags that are in the Controller Tags folder (controller scope).
3. If your MSG is to a module that uses 16-bit integers, use a buffer of INTs in the MSG and DINTs throughout the project.	If your message is to a module that uses 16-bit integers, such as a PLC-5® or SLC 500™ controller, and it transfers integers (not REALs), use a buffer of INTs in the message and DINTs throughout the project. This increases the efficiency of your project because Logix5000 controllers execute more efficiently and use less memory when working with 32-bit integers (DINTs).
4. If you want to enable more than 16 MSGs at one time, use some type of management strategy.	If you enable more than 16 MSGs at one time, some MSG instructions may experience delays in entering the queue. To guarantee the execution of each message, use one of these options: • Enable each message in sequence. • Enable the messages in smaller groups. • Program a message to communicate with multiple modules. • Program logic to coordinate the execution of messages.
5. Cache the connected MSGs that execute most frequently.	Cache the connection for those MSG instructions that execute most frequently, up to the maximum number permissible for your controller revision. This optimizes execution time because the controller does not have to open a connection each time the message executes.
6. Keep the number of unconnected and uncached MSGs less than the number of unconnected buffers.	The controller can have 10 - 40 unconnected outgoing buffers. The default number is 10. • If all the unconnected buffers are in use when an instruction leaves the message queue, the instruction errors and does not transfer the data. • You can increase the number of unconnected buffers to a maximum of 40.

For more information on programming MSG instructions, see the *Logix5000 Controller General Instructions Reference Manual*, publication 1756-RM003. The individual system user manuals for Logix5000 controllers also provide MSG examples unique to specific controller platforms.

Determining Connections for Messages

Messages transfer data to other modules, such as other controllers, I/O modules or operator interfaces. Each message uses one connection, regardless of how many modules are in the message path. To conserve connections, you can configure one message to read from or write to multiple modules. Also, you configure multiple messages for the same path and use only 1 connection if only 1 message is active at a time; however, this requires that you write your ladder logic correctly to make sure only 1 message is active at any time.

These connected messages can leave the connection open (cache) or close the connection when the message is done transmitting. The following table shows which messages use a connection and whether or not you can cache the connection:

This type of message:	Using this communication method:	Uses a connection:
CIP data table read or write	CIP	yes
PLC2, PLC3, PLC5, or SLC (all types)	CIP	no
	CIP with Source ID	no
	DH+	yes
CIP generic	CIP	your choice(1)
block-transfer read or write	na	yes

(1) You can connect CIP generic messages, but for most applications we recommend you leave CIP generic messages unconnected.

Guidelines for caching message connections

Follow these guidelines when you consider whether to cache a connection or not:

If the message executes:	Then you should:
repeatedly	cache the connection. This keeps the connection open and optimizes message completion time. Opening a connection each time the message executes increases execution time.
infrequently	do not cache the connection. This closes the connection upon completion of the message, which frees up that connection for other uses.

Entering Message Logic

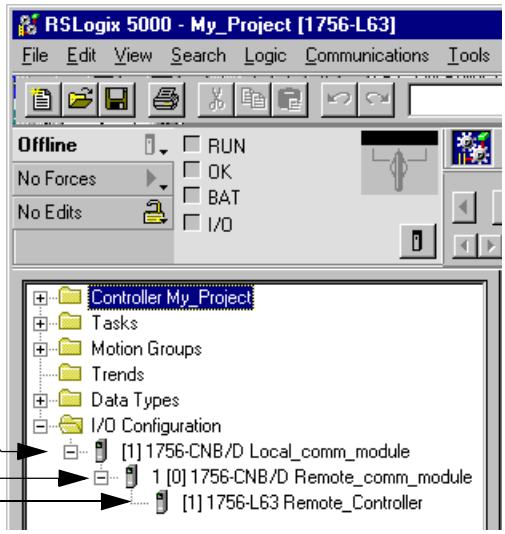
To send or receive data from a ControlNet module via a message, you must program a MSG instruction in the local controller's logic. If the target module is configured in the I/O Configuration folder of the controller, you can browse to select the module. Otherwise, you can manually enter the message path in the MSG instruction.

Add the ControlNet modules and remote devices to the local controller's I/O configuration

To use the Browse button to select the target device of a MSG instruction, you add that remote device to the I/O Configuration folder of the local controller. Within the I/O Configuration folder, you organize the local and remote devices into a hierarchy (tree/branch, parent/child).

For a typical local/remote MSG structure…

…you build the I/O configuration in this order



1. Add the local communication module for the local controller.
2. Add the remote communication module for the remote controller.
3. Add the remote controller.

   If the remote controller is added, you can browse to it as a destination when you configure the message instruction.

For more information on how to add ControlNet modules and remote devices to the local controller's I/O configuration, see Chapter 4.

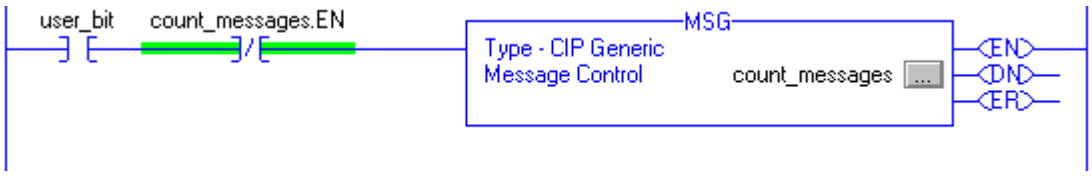
Enter a message

Use relay ladder logic to enter a MSG instruction. Click the ... button to configure the MSG instruction.

EXAMPLE

Enter a MSG instruction

If user_bit and count_messages.EN = 0 (i.e., MSG instruction is not already enabled), then execute a MSG instruction that sends data to another controller.



TIP

We recommend an XIO of the MSG control block tag.en (e.g., the *count_messages.EN* portion of the rung above) as an in series precondition for all message instructions

We also recommend that you do not manipulate the control bits of a message instruction.

Configuring a Message Instruction

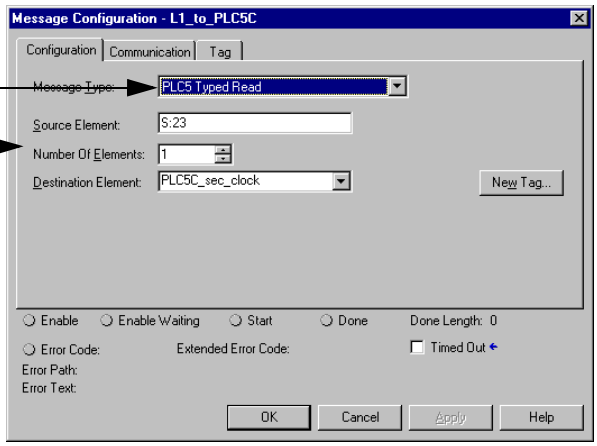
To configure a MSG instruction, do these tasks:

1. Click ... in the MSG box.
2. On the Configuration tab, specify the type of MSG instruction:

A. Choose a *Message Type*.

B. Depending on the Message Type, you have additional parameters to configure.

For more information on how to configure the various Message types, see Table 6.2, Table 6.3 and Table 6.4.



The message instruction's destination determines what specific information is used on the Configuration tab.

Table 6.1

To select a:	See:	On page:
Message Type to Configure a MSG to Logix5000 Controller	Table 6.2	6-7
Message Type to Configure a MSG to an SLC 500 Processor	Table 6.3	6-7
Message Type to Configure a MSG to a PLC-5 Processor	Table 6.4	6-8

Message Type to Configure a MSG to Logix5000 Controller

Table 6.2

If you want to:	For this item:	Type or select:
read (receive) the data	**Message Type**	*CIP Data Table Read*
	Source Element	first element of the tag that contains data in the other controller
	Number Of Elements	number of elements to transfer
	Destination Tag	first element of the tag (controller-scoped) in this controller for the data
write (send) the data	**Message Type**	*CIP Data Table Write*
	Source Tag	first element of the tag (controller-scoped) in this controller that contains the data
	Number Of Elements	number of elements to transfer
	Destination Element	first element of the tag for the data in the other controller

Message Type to Configure a MSG to an SLC 500 Processor

Table 6.3

If the data is:	And you want to:	For this item:	Type or select:
integer (s)	read (receive) data	**Message Type**	*SLC Typed Read*
		Source Element	data table address in the SLC 500 controller (e.g., N7:10)
		Number Of Elements	number of integers to transfer
		Destination Tag	first element of `int_buffer`
	write (send) data	**Message Type**	*SLC Typed Write*
		Source Tag	first element of `int_buffer`
		Number Of Elements	number of integers to transfer
		Destination Element	data table address in the SLC 500 controller (e.g., N7:10)

Table 6.3

If the data is:	And you want to:	For this item:	Type or select:
floating-point (REAL)	read (receive) data	**Message Type**	*SLC Typed Read*
		Source Element	data table address in the SLC 500 controller (e.g., F8:0)
		Number Of Elements	number of values to transfer
		Destination Tag	first element of the tag (controller-scoped) in this controller for the data
	write (send) data	**Message Type**	*SLC Typed Write*
		Source Tag	first element of the tag (controller-scoped) in this controller that contains the data
		Number Of Elements	number of values to transfer
		Destination Element	data table address in the SLC 500 controller (e.g., F8:0)

Message Type to Configure a MSG to a PLC-5 Processor

Table 6.4

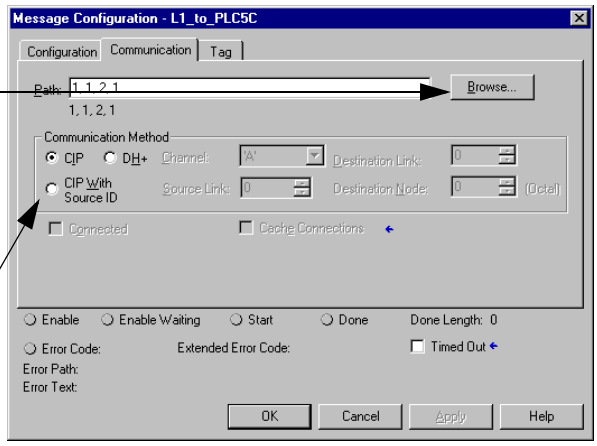
If the data is:	And you want to:	For this item:	Type or select:
integer (s)	read (receive) data	**Message Type**	*PLC5 Typed Read*
		Source Element	data table address in the PLC-5 controller (e.g., N7:10)
		Number Of Elements	number of integers to transfer
		Destination Tag	first element of `int_buffer`
	write (send) data	**Message Type**	*PLC5 Typed Write*
		Source Tag	first element of `int_buffer`
		Number Of Elements	number of integers to transfer
		Destination Element	data table address in the PLC-5 controller (e.g., N7:10)
floating-point (REAL)	read (receive) data	**Message Type**	*PLC5 Typed Read*
		Source Element	data table address in the PLC-5 controller (e.g., F8:0)
		Number Of Elements	number of values to transfer
		Destination Tag	first element of the tag (controller-scoped) in this controller for the data
	write (send) data	**Message Type**	*PLC5 Typed Write*
		Source Tag	first element of the tag (controller-scoped) in this controller that contains the data
		Number Of Elements	number of values to transfer
		Destination Element	data table address in the PLC-5 controller (e.g., F8:0)

3. On the Communication tab, specify the communications details:

A. If you added the module for which the message instruction is sent to the I/O configuration tree, you can use the Browse button to choose the path.

If you haven't added the module, you can type the path in manually, as described on page 6-9.

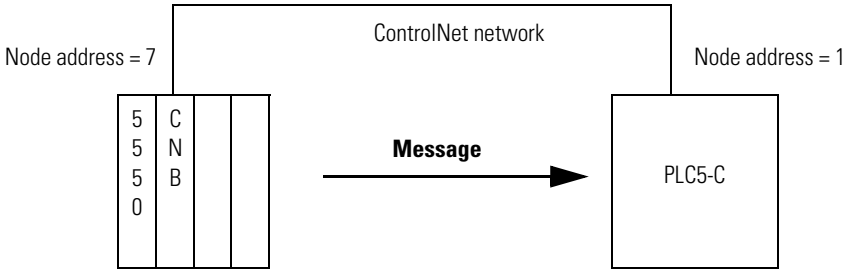
B. Select a *Communication Method*.



4. Click *OK*.

A manually entered path starts with the controller's connection to the backplane and follows a path as shown in the example below:

EXAMPLE Communication path from a Logix5000 controller to a PLC5 controller over a ControlNet network



Path = 1, 1, 2, 1

where:	indicates:
1	connection to the backplane in local chassis
1	slot number of 1756-CNB module in local chassis
2	connection to port 2 of the 1756-CNB module (get on ControlNet)
1	node address of remote PLC5

Communicating with PLC-5 or SLC 500 Processors

If the message is to a PLC-5 or SLC 500 processor and it reads or writes integers (not REALs), use a buffer of INTs in the message.

- Logix5000 controllers execute more efficiently and use less memory when working with 32-bit integers (DINTs).
- PLC-5 and SLC 500 processors require 16-bit integers
- Use an INT buffer in the message and move the data to or from DINTs as needed. Use the DINTs in the rest of the program; this can decrease the program scan..

IMPORTANT Logix5000 controllers can only send messages to SLC 500 processors over ControlNet if the SLC processor uses a KFC ControlNet communication card.

However, an SLC cannot send messages to Logix5000 controllers over ControlNet at all.

Initiating MSGs from PLC-5 Processors to Logix5000 Controllers

If the originating controller is a PLC-5 processor, in the MSG instruction, select *PLC5*.

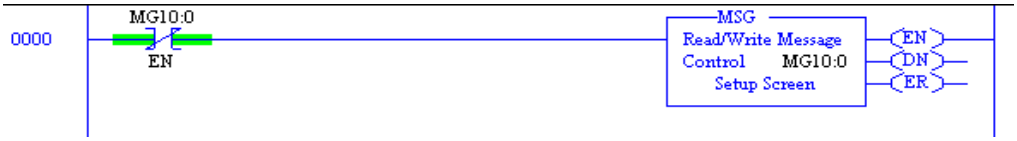


Figure 6.1 on page 6-10 shows how to configure the message above.

Figure 6.1

A. Select either a PLC5 Typed Read or PLC5 Typed Write for the Communication Command.

B. Type the starting address of the data in the PLC-5 controller.

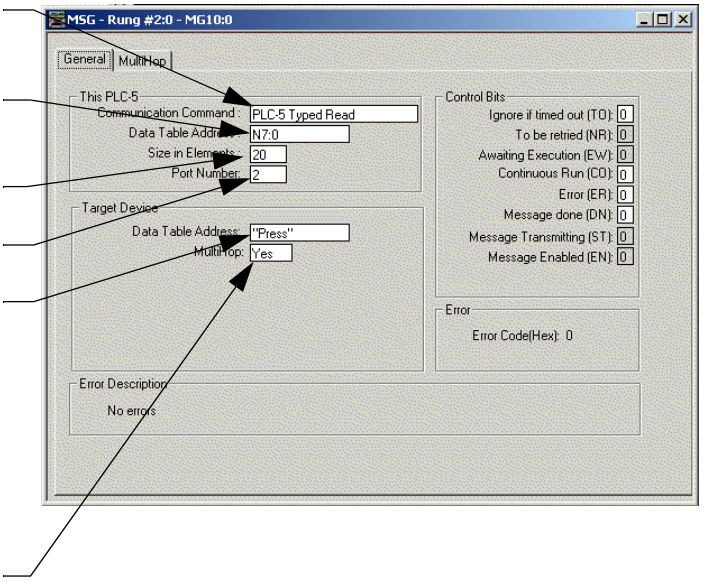
C. Type the number of elements to read or write.

D. Select Port Number 2 for ControlNet.

E. Type, in quotation marks, the tag name of the Logix5000 tag.

You can only specify the Logix5000 tag in quotation marks if the PLC is PLC-5C Series C/Revision M, Series D/Revision C, Series E/Revision B, Series F/Revision A or greater.

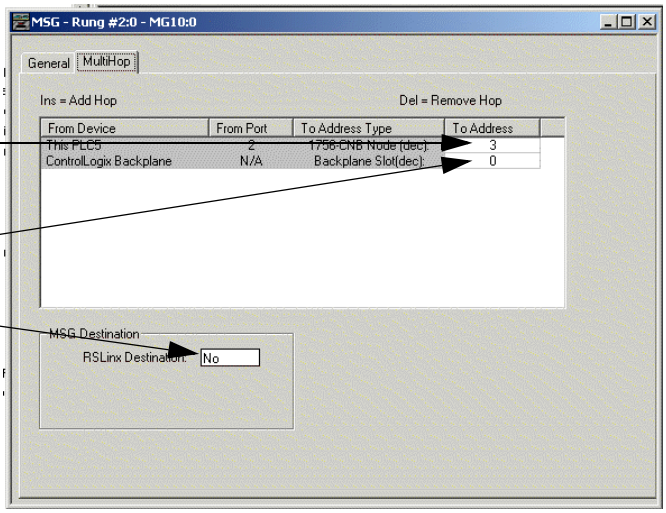
F. Select Yes for Multihop.



G. Type the node number of the destination 1756-CNB module.

H. Type the backplane slot number of the Logix5000 controller.

I. Select No for RSLinx Destination.



Mapping tags

A Logix5000 controller stores tag names on the controller so that other devices can read or write data without having to know physical memory locations. Many products only understand PLC/SLC data tables formatting, so the Logix5000 controller offers a PLC/SLC mapping function that lets you map Logix tag names to memory locations.

IMPORTANT The mapping function is particularly useful if your Logix5000 controller is communicating with a PLC-5C Series C/Revision L, Series D/Revision B, Series E/Revision A or earlier.

- You only have to map the file numbers that will be referenced by READ/WRITE messages requested from other controllers; the other file numbers do not need to be mapped. For example, if another controller will send a READ message only to N7, you need to map that file.
- The mapping table is loaded into the controller and is used whenever a “logical” address accesses data.
- You can only access controller-scoped tags (global data).
- For each file that is referenced in a PLC-5 command, make a map entry:
  - Type the PLC file number of the logical address.
  - Type or select the Logix5000 controller-scoped (global) tag that supplies or receives data for the file number. (You can map multiple files to the same tag.)
- For PLC-2 commands, specify the tag that supplies or receives the data.

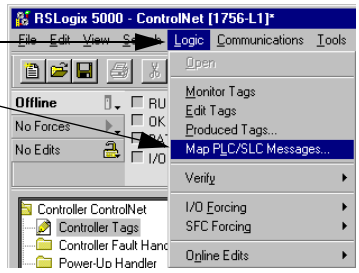
Follow these steps to map tags:

1. If the RSLogix 5000 project is online, go offline. You can only map tags when the project is offline.

2. Access the PLC/SLC Mapping screen.

A. Click Logic.

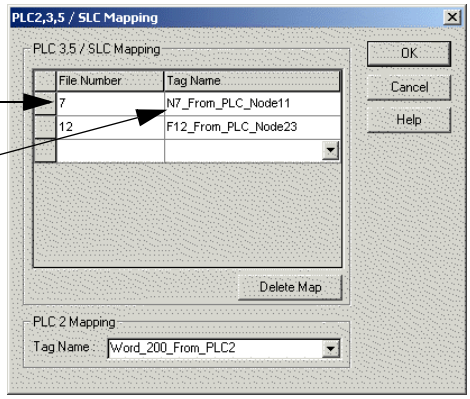
B. Click Map PLC/SLC Messages.



3. Configure the PLC/SLC Mapping as needed.

A. Type the File Number.

B. Type the corresponding Tag Name from the RSLogix 5000 project.



When mapping tags:

- Do not use file numbers 0, 1, and 2. These files are reserved for Output, Input, and Status files in a PLC-5 processor.
- Use PLC-5 mapping only for tag arrays of data type INT, DINT, or REAL. Attempting to map elements of system structures may produce undesirable effects.
- Use the PLC file identifier of N or B when accessing elements in an INT tag array.

Staggering the Messages

As you add messages to your project, you may have to coordinate the execution of the messages. To avoid errors and assure that each message is processed, follow these rules:

Rule 1:	Enable no more than 16 messages at one time (including block transfers).
Rule 2:	Enable no more than 10 of the following types of messages at one time: • CIP data table reads or writes that are *not* cached • CIP generic • PLC2, PLC3, PLC5, or SLC (all types) • block transfer reads or writes that are *not* cached

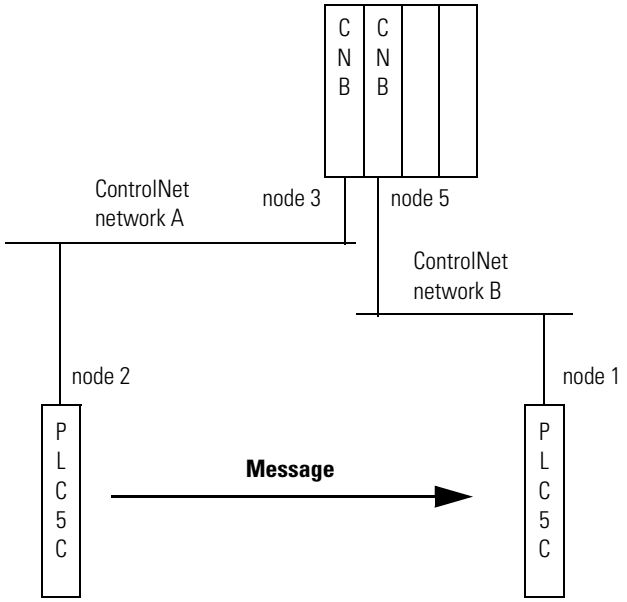
If the number of messages in your application exceeds rules 1 and 2, then stagger the execution of your messages. Here are some options:

- Send each message in sequence
- Send the messages in groups that are within the limits of rules 1 and 2
- Program a message to communicate with multiple devices.

Routing PLC-5 Messages Between ControlNet Networks

You can use ControlLogix communication modules to route a message between PLC-5 controllers that are on different networks (i.e., a bridged message). The following example depicts a ControlLogix chassis with two 1756-CNB modules that route a message from one ControlNet network to a different ControlNet network.

EXAMPLE Message from a PLC-5C on a ControlNet network to a PLC-5C on a different ControlNet network



Route a ControlNet Message

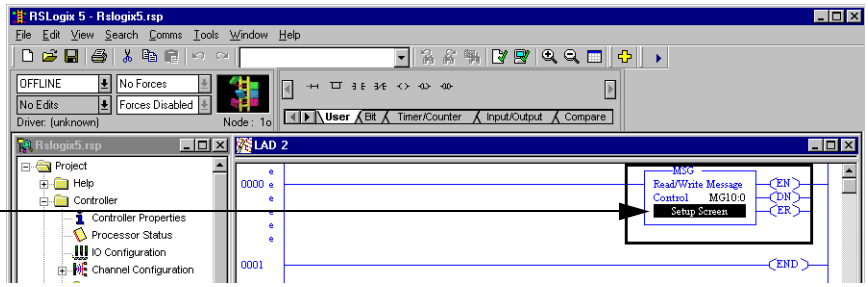
To send a message from a PLC-5C controller to a PLC-5C controller on a different ControlNet network:

IMPORTANT This section uses RSLogix 5™ software, revision 3.x or greater and PLC-5C Series C/Revision M, Series D/Revision C, Series E/Revision B, Series F/Revision A or greater

1. Open the RSLogix 5 project for the PLC-5 controller that sends the message.

2. Display the set-up screen for the message.

Double-click on *Setup Screen*.



3. Configure the General tab of the message instruction.

A. Type the *Communication Command*. Use either *PLC-5 Typed Read* or *PLC-5 Typed Write*.

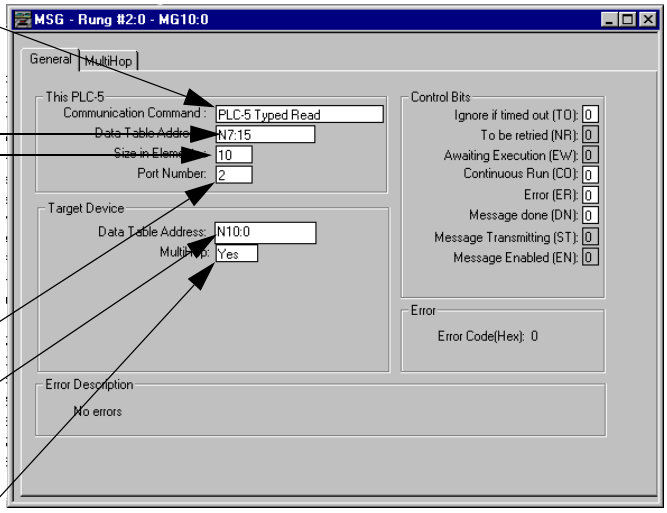
B. Type the starting address of the data in this PLC-5 controller (i.e., the controller sending the message).

C. Type the number of elements to write or read in *Size in Elements*.

D. Type the Port Number (always 2).

E. Type the starting address of the data in the controller that receives the message.

F. Choose Yes for *Multihop*.

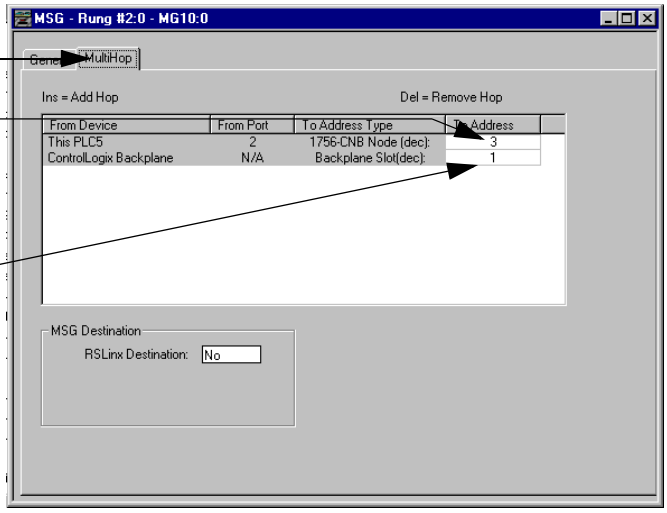


4. Configure the MultiHop tab.

A. Click on the *MultiHop* tab.

B. Type the ControlNet node number of the 1756-CNB module that is on the same ControlNet network as the controller that sends the message.

C. Type the slot number of the 1756-CNB module that is on the other network.



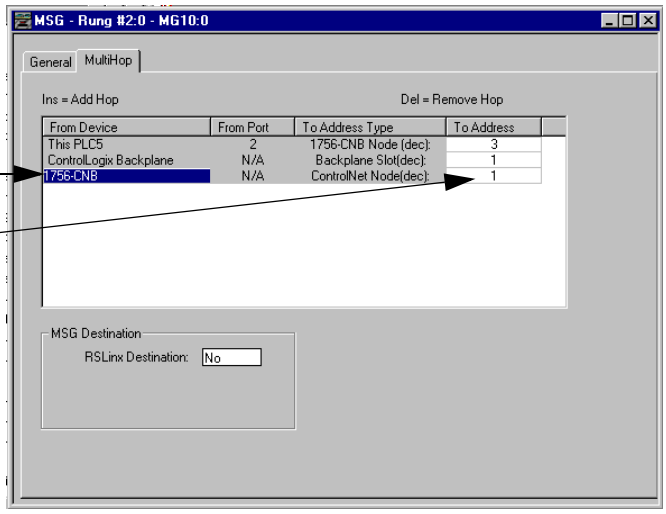
5. Select the ControlLogix backplane row.

6. Press the *Insert* key to add a hop.

7. Configure the new hop.

A. Select *1756-CNB*.

B. Type the ControlNet node number of the controller that receives the message.



Communicating with PanelView and RSView Products

Using This Chapter

Read this chapter for:

- *1756-CNB, 1756-CNBR modules*
- *1784-PCIC, 1784-PCICS cards*
- *1788-CNx cards*

This chapter describes how a controller uses a ControlNet communication module to communicate with PanelView and RSView products over a ControlNet network.

Set Up the Hardware

In this example, the controller in the local chassis shares data with an HMI application on the ControlNet network. This application could be running any of the following:

- PanelView terminal
- PanelView Plus terminal
- workstation running an RSView 32 software
- workstation running an RSView Enterprise application, such as RSView Machine Edition or RSView Supervisory Edition

The Logix5000 controller in the local chassis can be any of the following, with their ControlNet communication modules:

- 1756 ControlLogix controller with a 1756-CNB or 1756-CNBR communication module in the chassis
- 1789 SoftLogix controller with a 1784-PCIC or 1784-PCICS communication card
- 1794 FlexLogix controller with a 1788-CNx ControlNet communication card
- PowerFlex 700S with DriveLogix controller and a 1788-CNx ControlNet communication card

Make sure that:

- the ControlNet communication modules are connected to a scheduled ControlNet network
- all wiring and cabling is properly connected

Determining Connections to PanelView Terminals

How you establish communication between a PanelView or PanelView Plus terminal and a Logix5000 controller over ControlNet depends on how you want to use controller connections.

	Terminal type:	
Type of communications:	**PanelView:**	**PanelView Plus:**
scheduled (always connected)	supported	not supported
unscheduled connected	not supported	supported
unscheduled unconnected	supported	not supported

A Logix controller supports up to 40 outgoing and 3 incoming unconnected buffers. This limited number of incoming unconnected buffers limits how many terminals can request data from a controller at one time (i.e., a maximum of 3 PanelView terminals can request data from a Logix controller via unconnected communication at once). You can connect more than 3 PanelView terminals to a Logix controller via unconnected buffers but you must manage when each PanelView terminal requests data.

However, the Logix controllers, v11 and earlier, support up to 16 bidirectional connected buffers and Logix controllers, v12 or greater, support up to 32 bidirectional connected buffers. This larger number of connected buffers allows significantly more PanelView terminals to request data from the controller, as long as the request is made via connected communication–scheduled communication by a PanelView and unscheduled connected communication by a PanelView Plus.

For scheduled connected communication, you must add the PanelView terminal to the I/O configuration tree for the controller project. At the current time, because PanelView Plus terminals **ONLY SUPPORT** unscheduled connections, you are not required to add the terminals to the I/O configuration tree.

Adding a PanelView Terminal

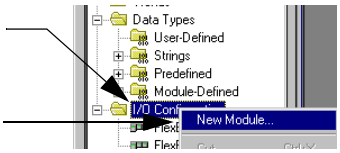
Adding a PanelView terminal is similar to adding distributed I/O. You add the local ControlNet communication module and then you add the terminal to that module.

1. If your application is online, go offline.

2. Select a New Module for the I/O Configuration.

A. Right-click on I/O Configuration.

B. Select New Module.



3. Select the local ControlNet communication module type from the Select Module Type pop-up. The example below uses a 1788-CNC card.

A. Select the local ControlNet communication module.

B. Click *OK*.

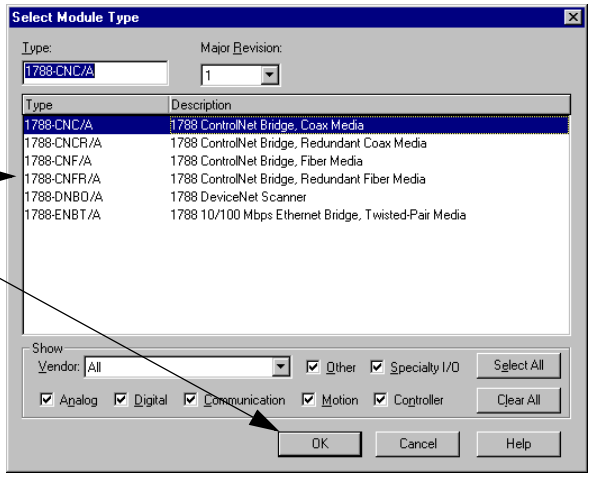
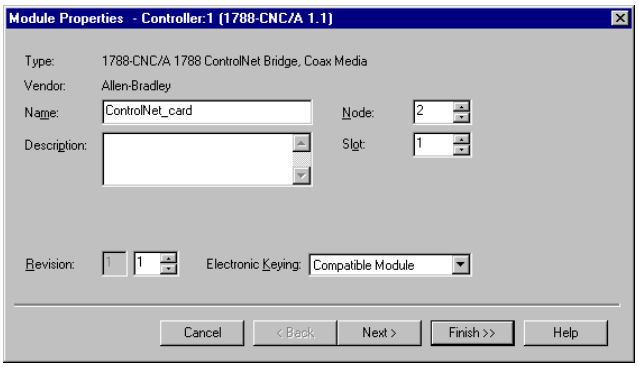


Table 7.1 lists the ControlNet communication modules available locally (i.e., in the local chassis, computer or controller) with each Logix5000 controller.

Table 7.1

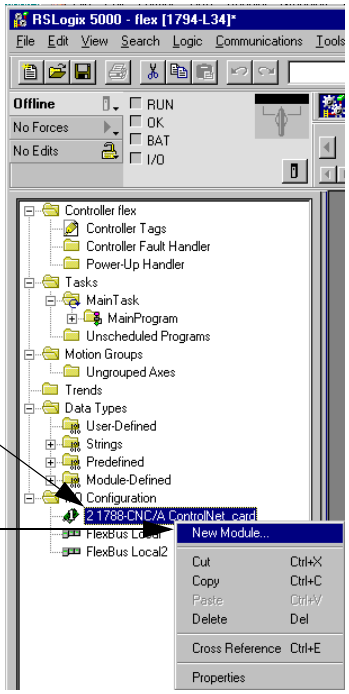
If you are using this Logix5000 controller:	You can use this ControlNet communication module locally:
ControlLogix	1756-CNB, 1756-CNBR
FlexLogix	1788-CNC, 1788-CNCR, 1788-CNF, 1788-CNFR
SoftLogix	1784-PCIC (scheduled data only), 1784-PCICS

4. Configure the local ControlNet communication module.



For more information on how to configure ControlNet communication modules, see Chapter 3.

5. Add a PanelView terminal to the project.



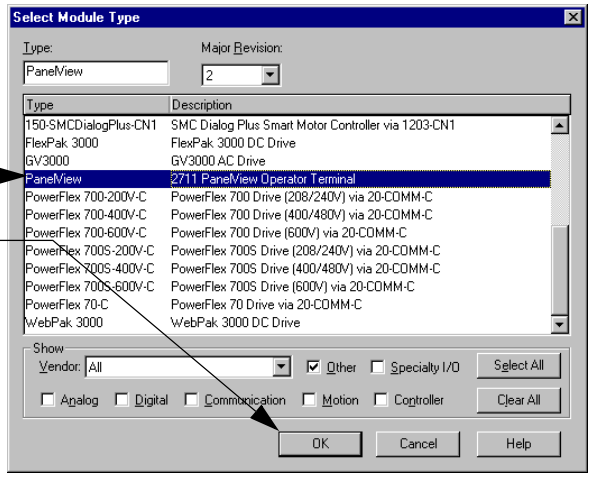
A. Right-click on the local communication module.

B. Select New Module.

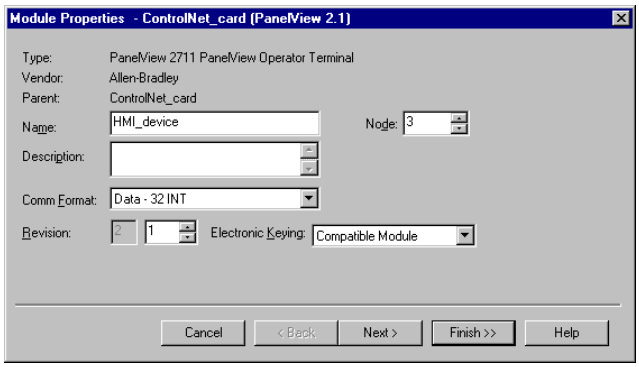
6. Select the PanelView terminal for your project.

A. Select the PanelView terminal.

B. Click OK.



7. Configure the terminal.



Organizing Controller Data for a PanelView Terminal

Organize data for a PanelView or PanelView Plus terminal based on how the data is used.

For data that is:	Do this:
time-critical (i.e., scheduled data) - PanelView terminals only	Use the I/O tags of the terminal. The terminal supports a maximum of 32 input tags and 32 output tags. The tags for this data were created when you added the PanelView terminal to the I/O configuration of the controller. They are similar to the tags of I/O modules.
not time-critical - either PanelView or PanelView Plus terminals	Create arrays to store the data: 1. For each screen, create a BOOL array with enough elements for the bit-level objects on the screen. For example, the BOOL[32] array gives you 32 bits for push buttons, indicators, etc. 2. For each screen, create a DINT array with enough elements for the word-level objects on the screen. For example, the DINT[28] array, give you 28 values for numeric entry controls, numeric displays, etc.

To access the scheduled I/O tags of the PanelView terminal, use the following address format:

If the terminal:	Then use this address:
writes the data	*name_of_terminal*:I.Data[*x*].*y*
reads the data	*name_of_terminal*:O.Data[*x*].*y*

where:

This address variable:	is:
name_of_terminal	name of the instance in the I/O configuration of the controller
x	element of the input (I) or output (O) structure.
y	bit number within the input or output element

Determining Connections to RSView Applications

RSView is a self-contained, PC-based HMI that offers both local and distributed client/server systems. This HMI can view updated tag information in a Logix5000 controller via OPC connectivity available in RSLinx.

How you establish communication to an RSView application depends on how you configure RSLinx software to collect tags from the controller. RSView 32 uses RSLinx Classic as a data server; RSView Enterprise uses RSLinx Enterprise as a data server.

RSLinx Classic and RSLinx Enterprise each default to 4 read connections and 1 write connection per configured controller. You can modify your RSLinx Classic configuration as needed (i.e., change the number of read and write connections). However, the RSLinx Enterprise is not configurable. You can only use a configuration of 4 read connections and 1 write connection.

Notes:

Troubleshooting Your ControlNet Communications Modules

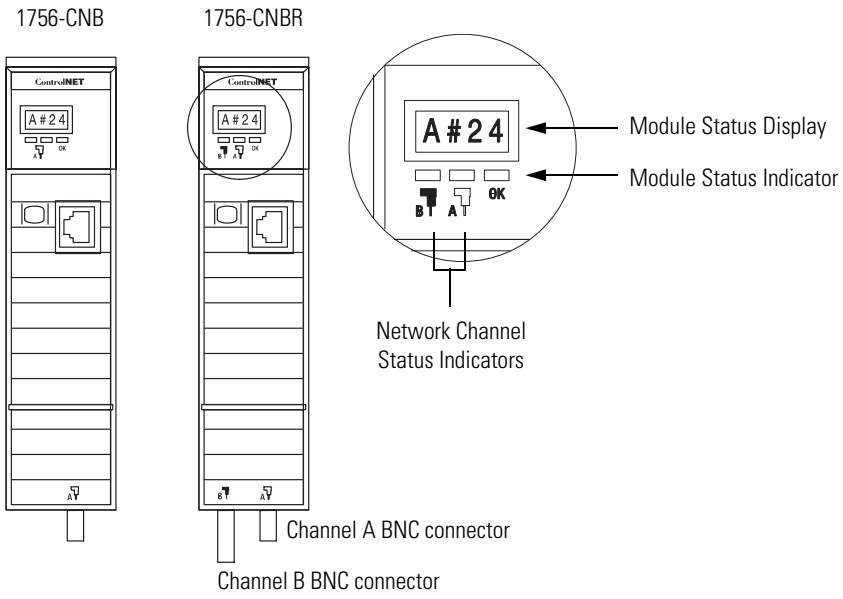
Using This Chapter

This chapter provides descriptions for status indicators used on the ControlNet communication modules and adapters and how to use those indicators to troubleshoot your application.

1756-CNB and 1756-CNBR ControlNet Communication Modules

Figure 8.1 shows the status indicators used on the 1756-CNB and 1756-CNBR modules.

Figure 8.1 1756-CNB and 1756-CNBR Status indicators



Module Status Indicator and Module Status Display Diagnostic Information

Table 8.1 describes the Module Status Indicator LED and Module Status Display diagnostic information.

Table 8.1 1756-CNB and 1756-CNBR Module Status Indicator and Display

If the OK indicator is:	With this module status display:	It means:	Take this action
off	None	Module not communicating due to a power supply fault or internal fault.	1. Check the power supply. 2. Check the cable connectors. 3. Make sure the module is firmly seated in the chassis. 4. If the indicator remains off, replace the module.

Table 8.1 1756-CNB and 1756-CNBR Module Status Indicator and Display

If the OK indicator is:	With this module status display:	It means:	Take this action
steady red	Msg scrolls[1]	Module's network address is set to 00, an invalid ControlNet address, or 99, an invalid ControlNet address if you are using redundant control. See footnote at end of table.	1. Optional – Turn chassis power supply off. 2. Remove the module from the chassis. 3. Set the network address switches to a unique address (01-99, or 01-98 if redundant control) 4. Install the module in the chassis. 5. If off, turn chassis power supply on.
	BPA# ERR	Module detected a different slot address from that latched in at power-up. Excessive noise on the backplane causes this error.	Replace the chassis or module.
	BPRX ERR	Too many CRC errors being generated by the multicast backplane receiver, so the backplane multicast receivers have been shut off.	Replace the module.
	BPIC ERR	Hardware fault within the module.	Replace the module.
	CNIC ERR		
	DUPL NODE	For a redundant system this may be a temporary condition during chassis switchover. Otherwise, the module's network address is the same as another module's on the link.	For redundant systems only. wait 10 seconds; if the condition persists, do the following steps: 1. Turn chassis power supply off. (Optional) 2. Remove the module from the chassis. 3. Set the network address switches to a unique address (01-99). 4. Install the module in the chassis. 5. If off, turn chassis power supply on.
	RACK ERR	Cannot read backplane EEPROM, or rack/slot address incorrect	Replace the chassis.
	STOP	CNB commanded to stop functioning by the redundancy module. This occurs when a non-redundancy compliant CNB is placed into a redundant secondary chassis.	Remove non-redundancy compliant CNB from redundant secondary chassis and replace with redundancy compliant CNB.
	WAIT RM	CNB waiting for the redundancy module to complete power-up.	None required.

Table 8.1 1756-CNB and 1756-CNBR Module Status Indicator and Display

If the OK indicator is:	With this module status display:	It means:	Take this action
flashing red	BOOT	Module has invalid firmware.	Update module firmware with ControlFlash Update Utility.
	ROM UPDT	Flash update is in progress.	None required.
	SNGL KPR!	Module detected that it has been connected to a Cnet 1.5 (single-keeper) network.	Update the CNB module's firmware at MAC ID 01 and reschedule the network.
steady green	OK	Normal operation	None required. In this case, at least one connection has been made to or through the 1756-CNB(R) module.
	INIT	Module is initializing.	None required
	BW >MAX	Module is receiving too much network traffic and connections are timing out. The network bandwidth has been exceeded.	None required (temporary condition). If this happens frequently, add another 1756-CNB(R) and split the traffic between them.
	CMPT	Secondary CNB is compatible with its partner.	None required.
	DSNP	Secondary CNB is disqualified with no partner.	Check corresponding slot of primary chassis for type and revision of module.
	PwDS	CNB is primary with a disqualified secondary partner.	Check the type and revision of the 1756-CNB module.
	PwQg	CNB is primary with a qualifying secondary partner.	Redundant system status. No action required.
	PwQS	CNB is primary with a qualified secondary partner.	
	PwNS	CNB is primary with no secondary partner.	Check corresponding slot of secondary chassis for correct module.
	Qfng	Secondary CNB is qualifying.	Redundant system status. No action required.
	QS	Secondary CNB is qualified.	
	SW ERR	Node address switch changed after power-up.	None required, but we recommend that you either return switches to their original settings or replace the module, since this could indicate a latent hardware problem.
flashing green	CNFG ERR	ControlNet configuration error.	Recheck configuration.
	NET ERR	Network cabling error or no other active nodes on network.	Re-check your network cabling and make sure another node on the network is active (on line).
	OK	Normal operation	None required. In this case, no connections have been made to or through the 1756-CNB(R) module.

Table 8.1 1756-CNB and 1756-CNBR Module Status Indicator and Display

If the OK indicator is:	With this module status display:	It means:	Take this action
steady green or off	SO_1	Old primary switchover phase 1 in progress.	If the display shows any message for more than three seconds, then the CNB module failed during transition from one redundancy phase to another. Replace one or both redundancy modules.
	SO_2	Old primary switchover phase 2 in progress.	
	SO_3	Old primary switchover phase 3 in progress.	
	SN_1	New primary switchover phase 1 in progress.	
	SN_2	New primary switchover phase 2 in progress.	
	SN_3	New primary switchover phase 3 in progress.	
	?Cpt	CNB has not determined if it is compatible.	
	!Cpt	CNB has determined that it is not compatible.	Replace the CNB module with correct type and revision.

(1) If switches are set to 00 the display scrolls "FAULT: ADDRESS SWITCHES = 00, ILLEGAL" If switches are set to 99 in a redundant chassis, the display scrolls: "FAULT: ADDRESS SWITCHES = 99, ILLEGAL IN REDUNDANT SYSTEM"

Network Channel Status Indicator Interpretation

IMPORTANT When you connect the module to a ControlNet network using only the network access port (NAP), the LEDs are meaningless.

- **steady** - indicator is on continuously in the defined state.
- **alternating** - the two indicators alternate between the two defined states at the same time (applies to both indicators viewed together). The two indicators are always in opposite states, out of phase.
- **flashing** - the indicator alternates between the two defined states (applies to each indicator viewed independent of the other). If both indicators flash, they must flash together, in phase.

Table 8.2 describes the 1756-CNB and 1756-CNBR network channel status indicators.

Table 8.2 1756-CNB and 1756-CNBR Network Channel Status Indicators

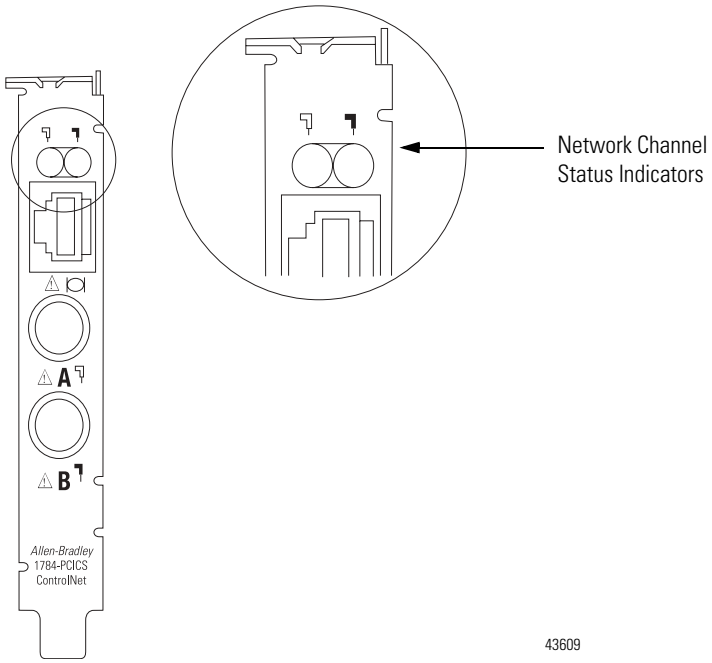
If both channel status indicators are:	It means:	Take this action:
off	no power	Apply power.
steady red	faulted module	1. Cycle power to the module. 2. If fault persists, contact your Rockwell Automation representative or distributor.
alternating red/green	self-test	None
alternating red/off	One of the following: • incorrect node configuration • duplicate ControlNet node address	Check 1756-CNB(R) node address and other ControlNet configuration parameters.
If either channel status indicators are:	**It means:**	**Take this action:**
off	channel disabled	Program network for redundant media, if necessary.
steady green	normal operation	None
flashing green/off	temporary network errors	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	node is not configured to go online	Make sure the network keeper is present and working and the selected address is less or equal to the UMAX(1).
flashing red/off	media fault	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	no other nodes present on network	Add other nodes to the network.
flashing red/green	incorrect node address	1. Change 1756-CNB(R) node address so that it is less than or equal to UMAX. 2. Stop and restart the PCIC/PCICS driver in RSLinx.
	incorrect network configuration	Reconfigure the ControlNet network so that UMAX is greater than or equal to the 1756-CNB(R) node address.

(1) UMAX is the highest node address on a ControlNet network that can transmit data.

1784-PCIC and 1784-PCICS ControlNet PCI Communication Interface Cards

Figure 8.2 shows the status indicators used on the 1784-PCIC and 1784-PCICS cards.

Figure 8.2 1784-PCIC and 1784-PCICS Channel Status indicators



The status indicators on the card give you information about the card and the ControlNet network when you are connected via the BNC connectors.

Network Channel Status Indicator Interpretation

IMPORTANT When you connect the module to a ControlNet network using only the network access port (NAP), the LEDs are meaningless.

- **steady** - indicator is on continuously in the defined state.
- **alternating** - the two indicators alternate between the two defined states at the same time (applies to both indicators viewed together). The two indicators are always in opposite states, out of phase.
- **flashing** - the indicator alternates between the two defined states (applies to each indicator viewed independent of the other). If both indicators flash, they must flash together, in phase.

Table 8.3 describes the 1784-PCIC and 1784-PCICS network channel status indicators.

Table 8.3 1784-PCIC and 1784-PCICS Network Channel Status Indicators

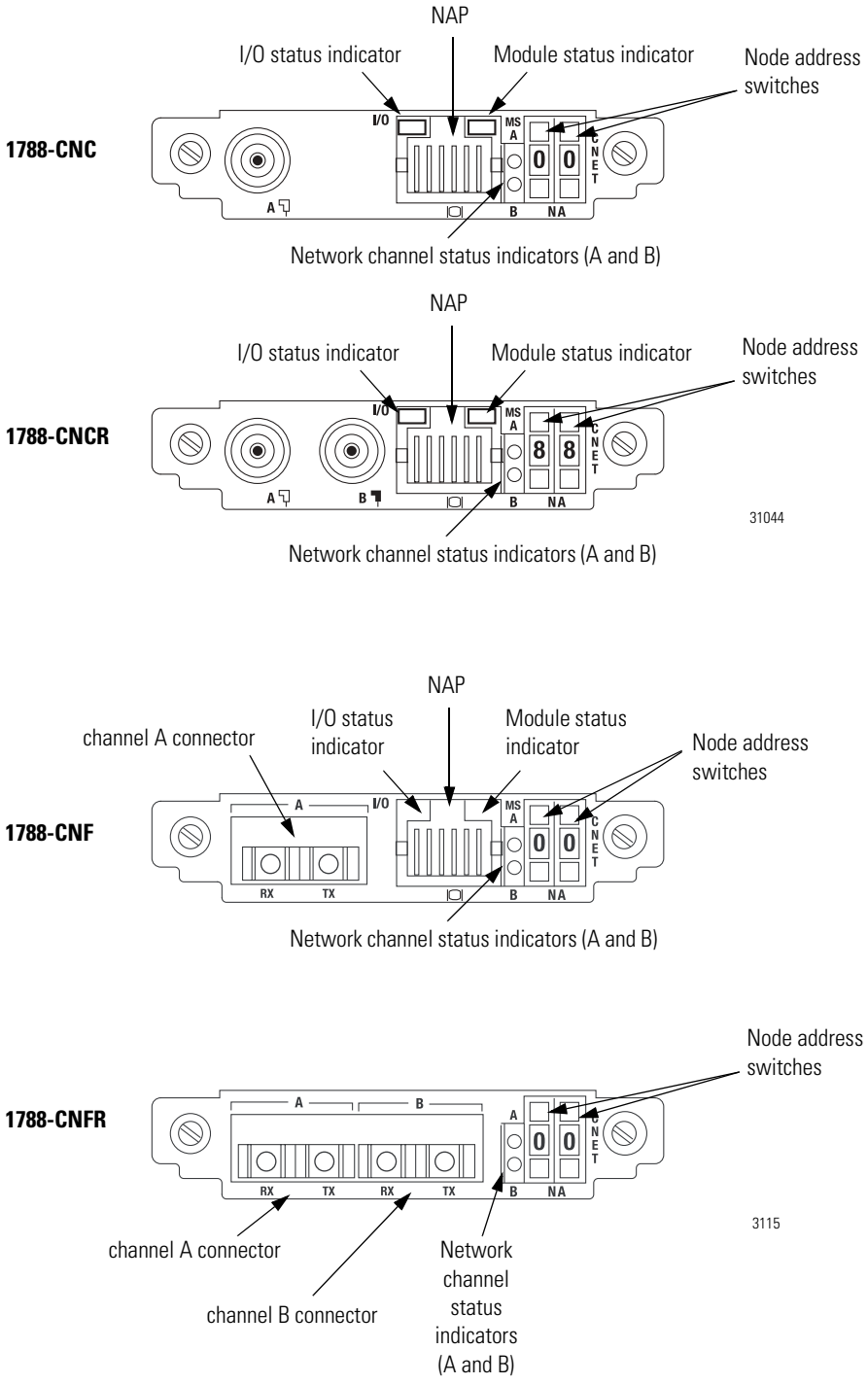
If both channel status indicators are:	It means:	Take this action:
off	no power	Apply power.
	1784-PCIC(S) driver not started	1. Start RSLinx. 2. Verify that the 1784-PCIC(S) driver has been configured properly in RSLinx.
	faulted card	1. Check operating system event log for details of fault (if the PC's operating system supports an event log). 2. Cycle power to the PC. 3. Verify that you have firmly inserted the 1784-PCIC(S) card into a PCI local bus expansion slot and that the expansion slot screw is tightened. 4. If fault persists, contact your Rockwell Automation representative or distributor.
	channel disabled	Program network for redundant media, if required
steady red	faulted card	1. Check operating system event log for details of fault (if the PC's operating system supports an event log). 2. Cycle power to the PC. 3. Verify that you have firmly inserted the 1784-PCIC(S) card into a PCI local bus expansion slot and that the expansion slot screw is tightened. 4. If fault persists, contact your Rockwell Automation representative or distributor.
alternating red/green	self-test	None
alternating red/off	One of the following: • incorrect node configuration • duplicate ControlNet node address	Check 1784-PCIC(S) node address and other ControlNet configuration parameters
steady green	normal operation	None
flashing green/off	temporary network errors	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
flashing red/off	media fault	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	no other nodes present on network	Add other nodes to the network.
flashing red/green	incorrect node address	1. Change 1784-PCIC(S) node address so that it is less than or equal to UMAX[(1)]. 2. Stop and restart the PCIC/PCICS driver in RSLinx.
	incorrect network configuration	Reconfigure the ControlNet network so that UMAX is greater than or equal to the 1784-PCIC(S) node address.

(1) UMAX is the highest node address on a ControlNet network that can transmit data.

1788-CNC, 1788-CNCR, 1788-CNF and 1788-CNFR ControlNet Daughtercards

Figure 8.3 shows the status indicators used on the 1788-CNC and 1788-CNCR cards.

Figure 8.3 1788-CNC, 1788-CNCR Status indicators



Module and I/O Status Indicator Interpretation

Status indicators provide information about the card and the network when you are connected via the BNC connectors.

- **steady** - indicator is on continuously in the defined state.
- **alternating** - the two indicators alternate between the two defined states at the same time (applies to both indicators when *viewed together*); the two indicators are always in opposite states, out of phase.
- **flashing** - the indicator alternates between the two defined states (applies to each indicator *viewed independent* of the other); if both indicators are flashing, they flash together, in phase.

IMPORTANT

Keep in mind that the Module Status indictor reflects the module state, e.g., self-test, firmware update, normal operation but no connection established, etc. The network status LEDs, A and B, reflect network status. Remember that the host is able to engage in local messaging with the card although it is detached from the network. Therefore, the Module Status LED is flashing green if the host has successfully started the card. Note, however, that until the host removes reset, all LEDs on the daughtercard will remain off.

When you view the indicators, always view the Module Status indicator first to determine the state of the daughtercard. This information may help you to interpret the network status indicators. As a general practice, view all three status indicators (Module Status, I/O Status, and Network Status) together to gain a full understanding of the daughtercard's status.

Table 8.4 describes the 1788-CNC, 1788-CNCR and 1788-CNF module and I/O status indicators.

Table 8.4 1788-CNC, 1788-CNCR and 1788-CNF Module and I/O Status Indicators

If the Module Status (MS) indicator is:	**It means:**	**Take this action:**
off	no power	Apply power.
	host is faulted	Make sure that the daughtercard is firmly seated in the slot.
	host is holding daughtercard in reset	1. Cycle power. 2. If the indicator remains off, replace the daughtercard or the host.
steady red	major fault	1. Cycle power. 2. If the problem persists, replace the daughtercard.
flashing red	minor fault	No action required (firmware update in progress.)
	firmware update in progress	No action required (firmware update in progress.)
	node address switch change – The daughtercard's node address switches may have been changed since power-up.	Change the node address switches back to the original setting. The module will continue to operate properly.
	invalid module firmware	Update module firmware with ControlFlash Update utility.
	duplicate node address – The daughtercard's node address duplicates that of another device.	1. Remove power. 2. Change the node address to a unique setting. 3. Reapply power.
steady green	connections established	None
flashing green	no connections established	Establish connections, if necessary.
flashing red/green	module is performing self-diagnostics.	Wait briefly to see if problem corrects itself If problem persists, check the host. If the daughtercard cannot communicate with the host, the card may remain in self-test mode.
If the I/O Status (IO) indicator is:	**It means:**	**Take this action:**
always off		This LED is on during the LED portion of the self-tests.

Network Channel Status Indicator Interpretation

IMPORTANT When you connect the module to a ControlNet network using only the network access port (NAP), the LEDs are meaningless.

- **steady** - indicator is on continuously in the defined state.
- **alternating** - the two indicators alternate between the two defined states at the same time (applies to both indicators viewed together). The two indicators are always in opposite states, out of phase.
- **flashing** - the indicator alternates between the two defined states (applies to each indicator viewed independent of the other). If both indicators flash, they must flash together, in phase.

Table 8.5 describes the 1788-CNC, 1788-CNCR, 1788-CNF and 1788-CNFR network channel status indicators.

Table 8.5 1788-CNC, 1788-CNCR, 1788-CNF and 1788-CNFR Network Channel Status Indicators

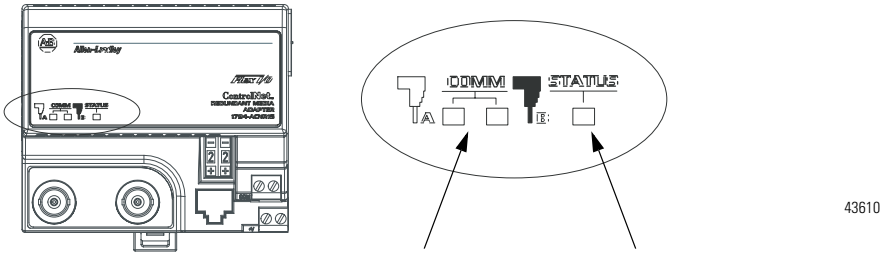
If both channel status indicators are:	It means:	Take this action:
off	channel disabled	Program network for redundant media, if necessary.
steady green	normal operation	None
flashing green/off	temporary network errors	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	node is not configured to go online	Make sure the network keeper is present and working and the selected address is less or equal to the UMAX[1].
flashing red/off	media fault	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	no other nodes present on network	Add other nodes to the network.
flashing red/green	incorrect network configuration	Reconfigure the ControlNet network so that UMAX is greater than or equal to the card's node address.
If either channel status indicators are:	**It means:**	**Take this action:**
off	you should check the MS indicators	check the MS indicators.
steady red	faulted card	1. Cycle power. 2. If the fault persists, contact your Rockwell Automation representative or distributor.
alternating red/green	the card is performing a self-test	None
alternating red/off	incorrect node configuration	Check the card's network address and other ControlNet configuration parameters.

[1] UMAX is the highest node address on a ControlNet network that can transmit data.

1794-ACN15 and 1794-ACNR15 ControlNet FLEX I/O Adapters

Figure 8.4 shows the status indicators used on the 1794-ACN15 and 1794-ACNR15 modules.

Figure 8.4 1794-ACN15 and 1794-ACNR15 status indicators



This graphic shows a 1794-ACNR15.

The modules use the following 2 status indicators:

- Comm - Communication status indicator for each channel; the 1794-ACN15 module has 1 Comm indicator, and the 1794-ANCR15 module has 2 Comm indicators
- Status - Module status indicator

Table 8.6 describes the 1794-ACN15 and 1794-ACNR15 communication status indicators.

Table 8.6 1794-ACN15 and 1794-ACNR15 Communication Status Indicators

If both channel status indicators are:	It means:	Take this action:
off	channel disabled	Program network for redundant media, if necessary.
steady green	normal operation	None
flashing green/off	temporary network errors	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	node is not configured to go online	Make sure the network keeper is present and working and the selected address is less or equal to the UMAX(1).
flashing red/off	media fault	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	no other nodes present on network	Add other nodes to the network.
flashing red/green	incorrect network configuration	Reconfigure the ControlNet network so that UMAX is greater than or equal to the module's node address.

Table 8.6 1794-ACN15 and 1794-ACNR15 Communication Status Indicators

If either channel status indicators are:	It means:	Take this action:
off	no power	Apply power.
steady red	faulted module	1. Cycle power. 2. If the fault persists, contact your Rockwell Automation representative or distributor.
alternating red/green	the module is performing a self-test	None
alternating red/off	incorrect node configuration	Check the module's network address and other ControlNet configuration parameters.

(1) UMAX is the highest node address on a ControlNet network that can transmit data.

Table 8.7 describes the 1794-ACN15 and 1794-ACNR15 module status indicators.

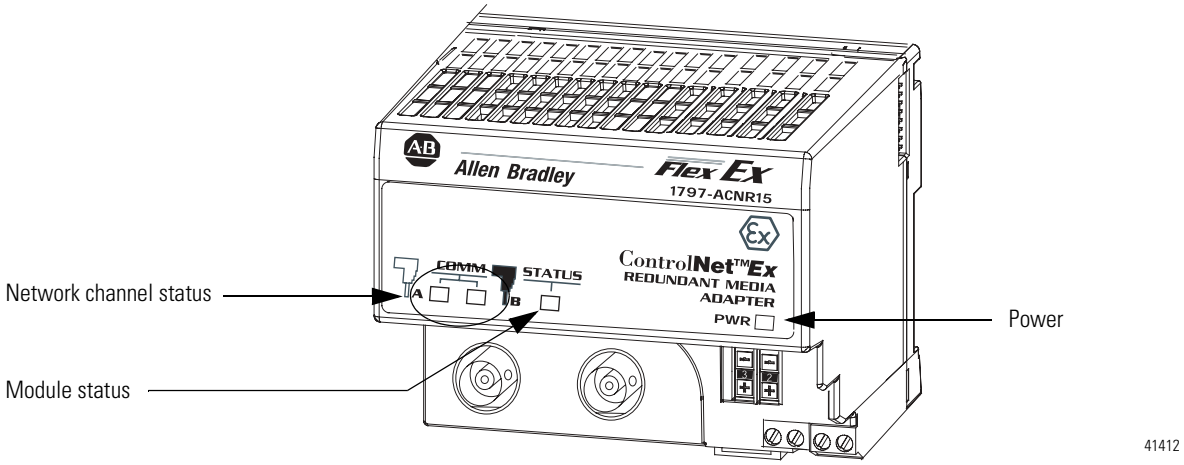
Table 8.7 1794-ACN15 and 1794-ACNR15 Module Status Indicators

If the module status indicator is:	It means:	Take this action:
off	Module not communicating due to a power supply fault or internal fault.	1. Check the power supply. 2. Check the cable connectors. 3. Make sure the module is properly installed on the DIN rail. 4. If the indicator remains off, replace the module.
steady green	connections established	None
flashing green	no connections established	Establish connections, if necessary.
steady red	major fault	1. Cycle power. 2. If the problem persists, replace the daughtercard.
flashing red	I/O module removed	Reinsert the module.
	wrong I/O module inserted	Replace the wrong module with the correct module.
	FLASH program update in progress	Wait for the program update to finish

1797-ACNR15 ControlNet FLEX Ex Redundant Media I/O Adapter

Figure 8.5 shows the status indicators used on the 1797-ACNR module.

Figure 8.5 1797-ACNR15 status indicators



The modules use the following 2 status indicators:

- Comm - Communication status indicator for each channel
- Status - Module status indicator

Table 8.8 describes the 1797-ACNR15 communication status indicators.

Table 8.8 1797-ACNR15 Communication Status Indicators

If both channel status indicators are:	It means:	Take this action:
off	channel disabled	Program network for redundant media, if necessary.
steady green	normal operation	None
flashing green/off	temporary network errors	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	node is not configured to go online	Make sure the network keeper is present and working and the selected address is less or equal to the UMAX(1).
flashing red/off	media fault	1. Check media for broken cables, loose connectors, missing terminators, etc. 2. If condition persists, refer to the ControlNet Planning and Installation Manual, publication 1786-6.2.1.
	no other nodes present on network	Add other nodes to the network.
flashing red/green	incorrect network configuration	Reconfigure the ControlNet network so that UMAX is greater than or equal to the module's node address.

Table 8.8 1797-ACNR15 Communication Status Indicators

If either channel status indicators are:	It means:	Take this action:
off	no power	Apply power.
steady red	faulted module	1. Cycle power. 2. If the fault persists, contact your Rockwell Automation representative or distributor.
alternating red/green	the module is performing a self-test	None
alternating red/off	incorrect node configuration	Check the module's network address and other ControlNet configuration parameters.

(1) UMAX is the highest node address on a ControlNet network that can transmit data.

Table 8.9 describes the 1797-ACNR15 module status indicators.

Table 8.9 1797-ACNR15 Module Status Indicators

If the module status indicator is:	It means:	Take this action:
off	Module not communicating due to a power supply fault or internal fault.	1. Check the power supply. 2. Check the cable connectors. 3. Make sure the module is properly installed on the DIN rail. 4. If the indicator remains off, replace the module.
steady green	connections established	None
flashing green	no connections established	Establish connections, if necessary.
steady red	major fault	1. Cycle power. 2. If the problem persists, replace the daughtercard.
flashing red	I/O module removed	Reinsert the module.
	wrong I/O module inserted	Replace the wrong module with the correct module.
	FLASH program update in progress	Wait for the program update to finish

Specifications

Using This Appendix

This appendix provides specifications for the ControlNet communication modules and adapters.

1756-CNB and 1756-CNBR ControlNet Communication Modules

		1756-CNB	1756-CNBR
ControlNet Interface	connectors	1 BNC connector for non-redundant media operation 1 NAP (RJ-45 8-pin with shield)	2 BNC connectors for redundant media operation 1 NAP (RJ-45 8-pin with shield)
	cable	quad shield RG-6 coaxial cable	
	ground isolation	transformer	
Electrical	power dissipation	5.14 W	
	thermal dissipation	17.5 BTU/hr	
	backplane current	970 mA @ 5.1 V 1.7 mA @ 24 V	1.0 A @ 5.1 V 1.7 mA @ 24 V
Environmental	operational temperature	0 to 60°C (32 to 140°F)	
	storage temperature	–40 to 85°C (–40 to 185°F)	
	relative humidity	5 to 95% (without condensation)	
Physical	location	any slot in a 1756 chassis	
	weight	0.260 kg (0.57 lb.)	0.293 kg (0.64 lb.)
Agency Certification (when product or packaging is marked)		Listed Industrial Control Equipment Certified Process Control Equipment Certified Class I, Division 2, Group A, B, C, D Approved class I, Division 2, Group A,B,C,D Marked for all applicable directives Marked for all applicable acts N223	

1784-PCC ControlNet PCMCIA Communication Card

General Specifications	
PCMCIA Type	Type II form-factor network adapter card
PCMCIA Standard	Compliant to PCMCIA Standard, release 2.1
Power Requirements	5V dc @ 225 mA maximum Class 2
Conductor	Category 2[2]
Environmental Specifications	
Operating Temperature[1]	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 50×C (32 to 122×F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85× C (-40 to 185× F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5-95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): Operating 30g Non-operating 50g
Emissions	CISPR 11: Group 1, Class A
Radiated RF Immunity	10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz
Certifications: (when product is marked)	UR UL Recognized Component Industrial Control Equipment CE[3] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[3] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions
1784-PCC1 Cable Specifications	
Total length of cable	120 cm

(1) The operating parameters describe the environment within the PCMCIA slot. Refer to the documentation for your computer for environmental requirements. The 1784-PCC card should not exceed those specifications.

(2) Refer to the ControlNet Cable System Planning and Installation Manual, publication CNET-IN002, when wiring your network. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for information about Category 2 wiring.

(3) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1784-PCIC and 1784-PCICS ControlNet PCI Communication Interface Cards

General Specifications	
PCI Local Bus	Compliant to PCI Rev. 2.2
Mechanical Form Factor	PCI 5V, 32-bit short card 4.2 in. (10.7 cm) H x 6.5 in. (16.5 cm) L
Driver Compatibility	Microsoft Windows NT 4.0 with Service Pack 3 or later Microsoft Windows 98 Microsoft Windows Me Microsoft Windows 2000 Microsoft Windows XP
Power Requirements	5 V dc, 700 mA Maximum, Class 2
Conductors	Category 2 Use this conductor category information when you plan conductor routing as described in publication 1770-4.1, Industrial Automation Wiring and Grounding Guidelines.
Environmental Specifications	
Ambient Operating Slot Temperature Rating	IEC 60068-2-1 (Test Ad, Operating Cold) IEC 60068-2-2 (Test Bd, Operating Dry Heat) IEC 60068-2-14 (Test Nb, Operating Thermal Shock) 0 to 50 °C (32 to 122 °F)
Ambient Storage Slot Temperature Rating	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold) IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat) IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock) -40 to 85 °C (-40 to 185 °F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat) 5 to 95%, non-condensing
Vibration (Operation)	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Shock	IEC60068-2-27 (Test Ea, Unpackaged Shock) Operating 30g Non-operating 50g
Emissions	CISPR 11 Group 1, Class A
ESD Immunity	IEC 61000-4-2 4kV contact discharges 8kV air discharges

Radiated RF Immunity	IEC 61000-4-3 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz
EFT/B Immunity	IEC 61000-4-4 ±2kV at 5kHz on communications ports
Surge Transient Immunity	IEC 61000-4-5 ±2kV line-earth (CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Agency Certifications (when product is marked)	UR — UL Recognized Component Industrial Control Equipment CSA — CSA Accepted Component for Process Control Equipment CSA — CSA Accepted Component for Process Control Equipment in Class I, Division 2 Group A,B,C,D Hazardous Locations CE(1) — European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(1) — Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx(1) — European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection “n” (Zone 2) CI — ControlNet Int’l conformance tested to ControlNet specifications.

(1) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1788-CNC and 1788-CNCR ControlNet Daughtercards

General Specifications	
Power Requirements[1] 1788-CNC 1788-CNCR	 5V dc @ 450 mA (maximum) 5V dc @ 475 mA (maximum)
Power Consumption 1788-CNC 1788-CNCR	 2.25 watts 2.375 watts
Power Dissipation 1788-CNC 1788-CNCR	 2.25 watts or 7.68 BTU/hour 2.375 watts or 8.1 BTU/hour
Wiring Connector Category	 200 micron cable (1786-FSxxx) with V-pin connectors and 1786-RPFS/RPA to connect to the network (1788-CNFR only) 2 - on communications ports[2]
Conductor	Category 2[3]
Weight 1788-CNC, 1788-CNCR	0.1 Kg (0.2 lb)
Environmental Specifications	
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60° C (32 to 140° F) It is accebtable for the ambient slot temperature immediately surrounding this product to reach 85×C (185×F) maximum
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85° C (-40 to 185° F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges

Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz

EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on communications ports
Surge Transient Immunity	IEC 61000-4-5: ±2kV line-earth(CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Agency Certification (when product or packaging is marked)	c-UR-us: UL Recognized Component Industrial Control Equipment, certified for US and Canada c-UR-us: UL Recognized Component Industrial Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for US and Canada CSA: CSA Certified Process Control Equipment CSA: CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE[4]: European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4]: Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions EEx[4]: European Union 94/9/EC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2) CI: ControlNet Int'l conformance tested to ControlNet specifications

(1) To comply with UL and CSA restrictions, this equipment must be powered from a source compliant with the following: Class 2 or Limited Voltage/Current, as defined in UL 508 Seventeenth Edition Section 32; and Separated Extra-Low-Voltage (SELV), as defined in CSA C22.2 No 1010, Annex H.

(2) Use this Conductor Category information for planning conductor routing. Refer to Publication 1770-4.1, "Industrial Automation Wiring and Grounding Guidelines".

(3) Refer to publication 1770-4.1, Programmable Controller Wiring and Grounding Guidelines.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1788-CNF and 1788-CNFR ControlNet Daughtercards

General Specifications	
Power Requirements[1] 1788-CNF 1788-CNFR	 5V dc @ 440 mA maximum 5V dc @ 450 mA maximum
Conductor	Category 2[2]
Environmental Specifications	This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, (as defined in IEC publication 664A) at altitudes up to 2000 meters without derating. Also refer to the user manual for your host device.
Temperature	This product is suitable for application in equipment that is rated 0 to 60°C (32 to 140°F) maximum. It is acceptable for the ambient slot temperature immediately surrounding this product to reach 85°C (185°F) maximum.
Weight	0.1 kg (0.2 lb.)
Agency Certifications When product it marked:	UL Recognized Component Industrial Control Equipment Certified component Process Control Equipment Certified component Class I, Division 2, Group A, B, C, D Marked for all applicable directives Marked for all applicable acts N223 ControlNet International Conformance Tested

(1) To comply with UL and CSA restrictions, this equipment must be powered from a source compliant with the following: Class 2 or Limited Voltage/Current, as defined in UL 508 Seventeenth Edition Section 32; and Separated Extra-Low Voltage (SELV), as defined in CSA C22.2 no. 1010, Annex H.

(2) Refer to publication 1770-4.1, Industrial Automation Wiring and Grounding Guidelines.

1794-ACN15 and 1794-ACNR15 ControlNet FLEX I/O Adapters

General Specifications	
I/O Capacity	8 modules
Power Supply	Note: In order to comply with CE Low Voltage Directives, you must use a Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV) power supply to power this adapter.
Input Voltage Rating	24V dc nominal 19.2V to 31.2 V dc (includes 5% ac ripple)
Communication Rate	5M bps
Indicators	I/O Status - red/green Comm A - red/green Comm B - red/green (1794-ACNR15 only)
Flexbus Output Current	640mA maximum
Isolation Voltage	Tested at 500V dc for 1s between user power and flexbus
Power Consumption	400mA maximum from external 24V supply
Power Dissipation	4.6W maximum @ 19.2V dc
Terminal Screw Torque	7 pound-inches (0.8Nm)
Dimensions	3.4H x 3.7W x 2.7D inches 87H x 94W x 69D mm
Conductors Wire Size Category	 12AWG (4mm^2) stranded copper wire rated at 75°C or higher 3/64 inch (1.2mm) insulation maximum 2(1)
ControlNet Cable	Belden RG-6/U
Environmental Specifications	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 55°C (32 to 131°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz
Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): Operating 30g Non-operating 50g

	Emissions	CISPR 11: Group 1, Class A (with appropriate enclosure)
	ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges
	Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz 10V/m with 200 50% Pulse 100% AM at 900MHz
	EFT/B Immunity	IEC 61000-4-4: ±2kV at 5kHz on signal ports
	Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line (DM) and ±2kV line-earth (CM) on signal ports
	Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 30MHz
	Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL	UL Listed Industrial Control Equipment
	CSA	CSA certified Process Control Equipment
	CSA	CSA certified for Class I, Division 2, Groups A, B, C and D Hazardous locations
	EEx[2]	European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2)
	CE[2]	European Union 89/336/EEC EMC Directive, compliant with: EN 61000-6-4; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity
	C-Tick[2]	Australian Radiocommunications Act compliant with AS/NZS CISPR 11, Industrial Emissions

(1) You use this category information for planning conductor routing as described in Allen-Bradley publication 1770-4.1, Industrial Automation Wiring and Grounding Guidelines.

(2) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1797-ACNR15 ControlNet FLEX Ex Redundant Media I/O Adapter

General Specifications	
I/O Capacity	8 modules
IS Media Type	EEx ib IIB/IIC T4, AEx ib IIC T4, Class I, Division 1 Groups A-G T4
IS Module Type	EEx ib IIB/IIC T4, AEx ib IIC T4, Class I Division 1 Groups A-D T4
Communication Rate	5M bit/s
ControlNet Ex BNC (ChA and ChB)	Oscillation powered by: $U_0 \leq 5.4V$ dc $I_0 \leq 160mA$ ac coupled with high-pass filter $f_{-3} \geq 500kHz$
Indicators	Comm A – red/grn Comm B – red/grn Module Status – red/grn Power – grn
Output (Intrinsically Safe) (16 position male/female flexbus connector)	$U_0 \leq 5.4V$ dc $I_0 \leq 400mA$ $P_0 \leq 2.16W$ $L_0 \leq 10\mu H$ $C_0 \leq 65\mu F$
Isolation Path Flexbus to Power Supply Flexbus to ControlNet ControlNet Ex Node to Other Node ControlNet Ex to Power Supply	 Galvanic to DIN EN50020 Galvanic functional Galvanic functional Galvanic to DIN EN50020
Power Supply (+V, -V Intrinsically Safe)	$U_i \leq 9.5V$ dc $I_i \leq 1A$ $P_i \leq 9.5W$ L_i = Negligible $C_i \leq 120nF$
Power Consumption	8.5W
Power Dissipation	8.5W
Thermal Dissipation	29 BTU/hr
Conductor Wire Size	12 gauge ($4mm^2$) stranded maximum 3/64in (1.2mm) insulation maximum
Weight	Approximately 200g

Environmental Specifications	
Operational Temperature	-20 to 70°C (-4 to 158°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Relative Humidity	5 to 95% noncondensing
Operating Shock	Tested 15g peak acceleration, 11 (±1) ms pulse width
Non-Operating Shock	Tested 15g peak acceleration, 11 (±1) ms pulse width
Vibration	Tested 2g @ 10-500Hz per IEC 68-2-6
Agency Certification	
CENELEC	II 2G EEx ib IIB/IIC T4
UL, C-UL	Class I Division 1 & 2 Groups A-D T4 Class I Zone 1 & 2 AEx ib IIC T4
FM	Class I Division 1 Groups A-D T4 Class I Zone 1 AEx ib IIC T4
Certificates	
CENELEC	DMT 99 ATEX E008 X
UL, C-UL	UL Certificate Number 99.19699 c UL us Class I Division 1 Hazardous
FM	FM Certificate Number 3010810

Connection Use Over ControlNet

Using This Appendix

Read this chapter for:

- *1756-CNB, 1756-CNBR modules*
- *1784-PCC, 1784-PCIC, 1784-PCICS cards*
- *1788-CNx cards*
- *1794-ACN15, -ACNR15 adapters*
- *1797-ANCR adapter*

ControlNet communication modules use connections to manage communications. A connection is a point-to-point communication mechanism that transfers data between a transmitter and a receiver.

ControlNet communication modules use connections that transfer data from a Logix application running on one end-node to another device (e.g. Logix application, I/O etc.) running on another end-node.

ControlNet Connections

Connections are allocations of resources that provide faster more reliable communications between modules than unconnected messages. The ControlNet communication modules and adapters support both direct and rack-optimized connections to remote I/O adapters.

Connected messaging supports the following example functions:

- Logix controller message transfer to Logix controller
- I/O or produced/consumed tag
- Program upload
- RSLinx DDE/OPC client
- PanelView polling of Logix controller

There are different types of ControlNet connections:

Connection type:	Description:
bridged	A connection that passes through the ControlNet module. The end point of the connection could be an I/O module, another ControlNet node, another controller or a device on a different network (bridged). **Example:** a connection from a controller through a 1756-CNB and 1756-CNBR to another controller.
rack-optimized scheduled	A rack-optimized connection is a connection to a rack or assembly object in the ControlNet module. Data from selected I/O modules is collected and produced on one connection (the rack-optimized connection) rather than on a separate direct connection for each module.
direct scheduled	A connection from a controller to an specific I/O module (as opposed to a rack-optimized connection).
produced/consumed tag scheduled	A connection that allows multiple controllers to share tags. One controller produces the tag and one or more controllers consume it.

The Logix5000 controller supports 250 connections. But the limit of connections ultimately resides in the communication module you use for the connection. If a message path routes through a communication module or card, the connection related to the message also counts towards the connection limit of the communication module or card.

Connected Messaging Limits

<table>
<tr><th>Product:</th><th>Connected Messaging Limits:</th></tr>
<tr><td>1756-CNB and 1756-CNBR</td><td>Each module supports 64 connections.
5 controllers can have a rack-optimized connection to the module
5 controllers can have a rack-optimized, listen-only connection to the module</td></tr>
<tr><td>1784-PCC</td><td>Each module supports 31 unscheduled connections.</td></tr>
<tr><td>1784-PCIC</td><td>Each module supports 128 unscheduled connections.</td></tr>
<tr><td>1784-PCICS</td><td>Each module supports 128 unscheduled and 127 scheduled connections.</td></tr>
<tr><td>1788-CNx</td><td>Each module supports 32 connections, of which 22 connections can be scheduled connections.</td></tr>
<tr><td>1794-ACN15, 1794-ACNR15 and 1797-ANCR</td><td>Each module supports a maximum 32 end-node connections for messages. With these cards, the number of end-node connections they support is dependent on the application's NUT:
<table>
<tr><th>At this NUT:</th><th>The cards support this many end-node connections</th></tr>
<tr><td>2.0 - 2.99ms</td><td>3</td></tr>
<tr><td>3.0 - 3.99ms</td><td>12</td></tr>
<tr><td>4.0 - 7.99ms</td><td>20</td></tr>
<tr><td>8.0 - 100.0</td><td>32</td></tr>
</table></td></tr>
</table>

Unconnected Messaging Limits

The following limits of unconnected messages are the maximum number of outstanding unconnected messages. These are unconnected messages that have been sent to the module and are being processed and have not yet generated a response or timeout.

Product:	**Unconnected Messaging Limits:**
1756-CNB and 1756-CNBR	Each module supports up to 20 unconnected messages
1784-PCC	Each module supports up to 50 unconnected messages
1784-PCIC and 1784-PCICS	Each module supports up to 50 unconnected messages
1788-CNx	Each module supports up to 20 unconnected messages.
1794-ACN15, 1794-ACNR15 and 1797-ACNR15	Each module supports up to 16 unconnected messages.

Notes:

ControlNet Overview

This chapter defines some basic ControlNet concepts and how the ControlNet network is used for control.

Understanding the ControlNet Network

ControlNet is a real-time control network that provides high-speed transport of both time-critical I/O and interlocking data and messaging data, including upload/download of programming and configuration data on a single physical media link. The ControlNet network's highly efficient data transfer capability significantly enhances I/O performance and peer-to-peer communication in any system or application where it is used.

ControlNet is highly deterministic and repeatable, and remains unaffected as devices are connected or disconnected from the network. This ensures dependable, synchronized, and coordinated real-time performance.

The ControlNet network is most often used in these types of configurations:

- as the default network for the ControlLogix platform
- as a substitute/replacement for the Remote I/O (RIO) network, because ControlNet handles large numbers of I/O points well
- as a backbone to multiple distributed DeviceNet networks
- as a peer interlocking network
- instead of Data Highway Plus

Exchanging Information on ControlNet

ControlNet communication modules use a message-based protocol that implements a relative path to send a message from the producing module in a system to the consuming modules. This protocol also allows you to communicate between devices on ControlNet and DeviceNet or EtherNet/IP without writing additional application code.

With unscheduled data (a full explanation of unscheduled and scheduled data is available on page C-3), the device where a message originates (e.g. a Logix5000 controller) contains the path information that steers the message along the proper route to reach its consumers. Since the producing module holds this information, other modules along the path simply pass this information; they do not need to store it. This has two significant benefits:

- You do not need to configure routing tables in the bridging module, which greatly simplifies maintenance and module replacement.
- You maintain full control over the route taken by each message, which enables you to select alternative paths for the same end module.

Scheduled data in Logix-based systems use the producer/consumer networking model instead of a source/destination (master/slave) model. The producer/consumer model reduces network traffic and increases speed of transmission. In traditional I/O systems, controllers poll input modules to obtain their input status. In a Logix system digital input modules are not polled by a controller. Instead, they produce (multicast) their data either upon a change of state (COS) or periodically. The frequency of update depends upon the options chosen during configuration and where on the network the input module resides. The input module, therefore, is a producer of input data and the controller is a consumer of the data.

The controller can also produce data for other controllers to consume. The produced and consumed data is accessible by multiple controllers over the Logix backplane and over the ControlNet network. This data exchange conforms to the producer/consumer model.

A ControlNet link's most important function is to transport time-critical control information (i.e., I/O data and control interlocking). Other information (i.e., non-time-critical messages such as program uploads and downloads) is also transported but does not interfere with time-critical messages because of ControlNet's transmission of scheduled and unscheduled data.

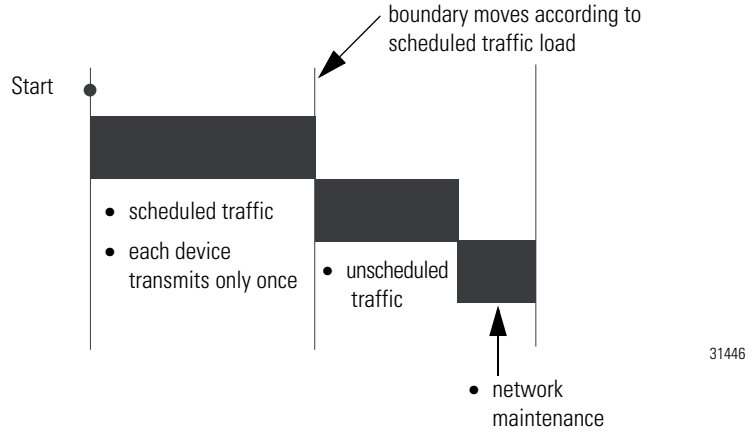
On a ControlNet link, information is transferred between nodes by establishing connections. Each message sent by a producer contains a Connection ID (CID). Nodes that have been configured to recognize the CID consume the message, therefore becoming consumers.

Media access to the network is controlled by a time-slice access algorithm, Concurrent Time Domain Multiple Access (CTDMA), which regulates a node's opportunity to transmit in each network update interval (NUI). You configure how often the NUI repeats by selecting a network update time (NUT) in milliseconds. The minimum NUT you can specify is 2 ms. The NUT is divided into three parts:

Table C.1

This part of the NUT	allows
scheduled	every scheduled node (on a rotating basis in sequential order) is given one guaranteed opportunity to transmit per NUT. Information that is time-critical is sent during this part of the interval.
unscheduled	all nodes transmit on a rotating basis in sequential order. This rotation repeats until the time allotted for this portion is used up. The amount of time available for the unscheduled portion is determined by the traffic load of the scheduled portion. ControlNet guarantees at least 1 node will have the opportunity to transmit unscheduled data every NUT. Information that can be delivered without time constraints is sent during this part of the interval.
maintenance	the node with the lowest address transmits information to keep the other nodes synchronized. This time is automatically subtracted from your NUT. However, the time required for network maintenance is small (i.e., in microseconds) when compared to that used for the scheduled and unscheduled portions of the NUT.

Figure C.1



Network Update Time (NUT)

The network update time (NUT) is the smallest repetitive time interval in which data can be sent on the ControlNet network. It represents the fastest possible update rate for scheduled data transfers on that network. For example, a network that runs with a 5ms NUT cannot send scheduled data at a rate faster than 5ms. It can, however, send data at a slower rate.

Requested Packet Interval (RPI)

The RPI is the update rate specified for a particular piece of data on the network. The RPI can be specified for an entire rack of I/O (using a rack-optimized connection), for a particular module (using a direct connection) or peer-to-peer data. When you add a module to the I/O configuration of a controller, you must configure the RPI. This value specifies how often to produce the data for that module. For example, if you specify an RPI of 50ms, every 50ms the I/O module sends its data to the controller and/or the controller sends its data to the I/O module.

Set the RPI only as fast as needed by the application. The RPI also determines the number of packets per second that the module will handle on a connection. Each module has a limit of how many packets it can handle per second. If you exceed this limit, the module cannot open any more connections.

Keep in mind that the faster your RPI, the more network bandwidth used. So only set the RPI as fast as necessary to avoid draining the network bandwidth unnecessarily. For example, if your application uses a thermocouple module that has data change every 100ms, do not set the RPI for that node at 5ms because the network bandwidth is used for data transmissions that are mostly old data.

IMPORTANT You cannot set the RPI to a rate faster than the NUT. The network cannot send data at a rate that is faster than NUT.

When you run RSNetWorx for ControlNet an Actual Packet Interval (API) is calculated. The API is equal to or faster than the RPI.

Actual Packet Interval (API)

The API is the actual update rate for a particular piece of data on the network. ControlNet will set this rate equal to or faster than the RPI, based upon the binary multiple of the NUT which is the next fastest rate at which a module can send data. If this can not be done, ControlNet will provide feedback that the configuration can not be supported.

Understanding the Effect of the NUT on the API

The following example illustrates how the NUT affects the API. A module on the network can produce data only at binary multiples of the NUT to a maximum of the NUT multiplied by 128. These multiples are referred to as "rates" on ControlNet. Therefore, in the example of a NUT of 5 ms, the module can send data at the following rates:

Table C.2

With this NUT:	and this multiple:	The module can send data at this rate:
5ms	1	5ms
	2	10ms
	4	20ms
	8	40ms
	16	80ms
	32	160ms
	64	320ms
	128	640ms

In our example, if you specify an RPI of 25ms, then the network produces an API of 20ms, which is the next fastest rate at which the module can send data. The module places the data on the network at every fourth network update interval to produce the 20ms API. Similarly, if you specify an RPI of 150ms, the network produces an API of 80ms.

Scheduling the Network

Connections over ControlNet can be:

- scheduled - data transfers occur at specific times

  or

- unscheduled - data transfers occur when the network can accommodate the transfer

To use scheduled connections, you must schedule the ControlNet network via RSNetWorx for ControlNet. For more information on how to schedule a ControlNet network with RSNetWorx for ControlNet, see page 3-11.

You must use RSNetWorx for ControlNet to enable any connection in a remote chassis. In addition, RSNetWorx transfers configuration information for the remote modules, verifies and saves NUT and other user-specified network parameters, and establishes a schedule that is compliant with the RPIs and other connection options specified for each module.

IMPORTANT RSNetWorx must be run whenever a scheduled connection is added to, removed from, or changed in your system.

Control of Scheduled I/O

Scheduled connections allow you to send and to receive data repeatedly at a predetermined rate. You can use the 1756-CNB module to control scheduled I/O when you use it in conjunction with a ControlLogix controller. When you place the module in the I/O configuration list of a ControlLogix controller and configure a second ControlLogix chassis, with a remote 1756-CNB module, on the same ControlNet network, you can perform remote control operations on the I/O, or to a second controller, in the second chassis.

In this situation, the ControlLogix controller and the 1756-CNB module in the local chassis together act as a scanner, while the 1756-CNB module in the remote chassis with the I/O plays the role of an adapter.

Understanding the Network Keeper

Every ControlNet network requires at least one module that stores programmed parameters for the network and configures the network with those parameters at start-up. This module is called a "keeper" because it keeps the network configuration. RSNetWorx for ControlNet configures the keeper.

To avoid a single point of failure, ControlNet supports multiple redundant keepers. The following ControlNet communication modules are keeper cable devices:

- 1756-CNB(R) modules
- 1784-PCICS card
- 1788-CNx cards
- PLC-5C module

On a multi-keeper network, any keeper capable module can keep the network at any legal node address (01 to 99). The multi-keeper capable node with the lowest node address becomes the active keeper provided it is valid (i.e., it has been configured by RSNetWorx and that configuration is the same as that of the first keeper that became active after the network was formed or reconfigured by RSNetWorx).

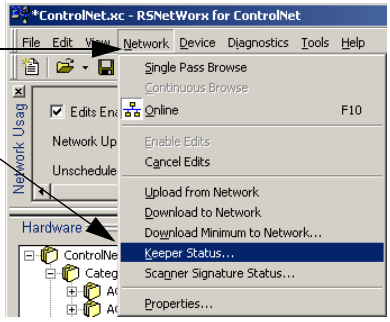
If the active keeper is taken off the network, a valid back-up keeper can take over for it and continue to act as keeper. As long as at least one valid multi-keeper device is present on the network, new scheduled connections can be established.

To see a list of valid keeper devices on your network, do the following steps:

1. Go online in RSNetWorx for ControlNet.
2. Access the Keeper Status for the network.

A. Click Network.

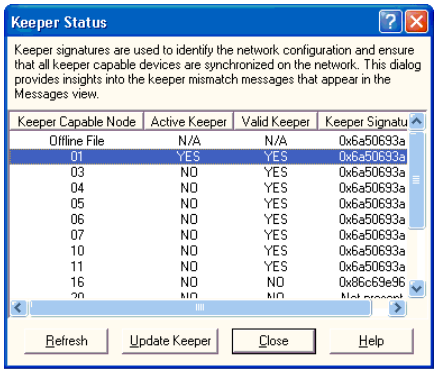
B. Click Keeper Status.



The Keeper Status screen appears with a list of all nodes on the network and indications of whether the nodes are:

- Keeper Capable Nodes
- Active Keeper
- Valid Keepers

The screen below shows an example of the Keeper Status screen.



Default Parameters

When a ControlNet network is powered-up for the first time, it comes up with a default set of ControlNet parameters capable of sending only unscheduled data. The default set of network parameters in all ControlNet devices, is:

- Network Update Time (NUT) = 100ms
- Scheduled Maximum Node Address (SMAX) = 0

  The SMAX is the highest network address of a node that can use the scheduled service.

- Unscheduled Maximum Node Address (UMAX) = 99

  The UMAX is the highest network address of a node that can communicate on the ControlNet network. The UMAX must be set equal to or higher than the SMAX.

- Assumed maximum cable lengths and maximum number of repeaters

With this default ControlNet network, you can have unscheduled communication between the various devices on the network by using such packages as RSNetWorx for ControlNet, RSLogix5000 and RSLinx.

IMPORTANT

The ControlNet network should be configured using RSNetWorx for ControlNet to improve performance.

At a minimum, we recommend that the Unscheduled Maximum Node Address (UMAX) be set equal to the highest node address on the network. Leaving this parameter at the default value of 99 will waste bandwidth and reduce system performance.

We also recommend setting the Scheduled Maximum Node Address (SMAX) to a value 3 or 4 above the highest scheduled node address to allow you to expand the network in the future.

ControlNet Capacity and Topology

When planning a ControlNet network, you should consider the following:

- topology
- number of nodes
- distances
- connections

Topology

ControlNet supports a variety of topologies, including trunkline/dropline, star, tree, and ring redundancy. In its simplest form, ControlNet is a trunkline, to which you connect nodes with a tap and a 1-meter dropline, as shown in Figure C.2.

Repeaters are required to create other topologies, as shown in Figure C.3 (star) and Figure C.4 (ring).

TIP

- Coax repeaters are typically used in trunkline and star topologies. Refer to publication CNET-IN002, ControlNet Coax Media Planning and Installation Guide, for more specific information on coax topologies you can create.

- Using fiber media allows you to configure your network in trunkline and star topologies and is the only method of implementing ring redundancy. You can only use the 1786-RPFRL and 1786-RPFRXL repeaters in a ring.

  Refer to publication CNET-IN001, ControlNet Fiber Media Planning and Installation Guide, for more information on fiber media and topologies.

Figure C.2 Example ControlNet System Trunkline/Dropline Topology

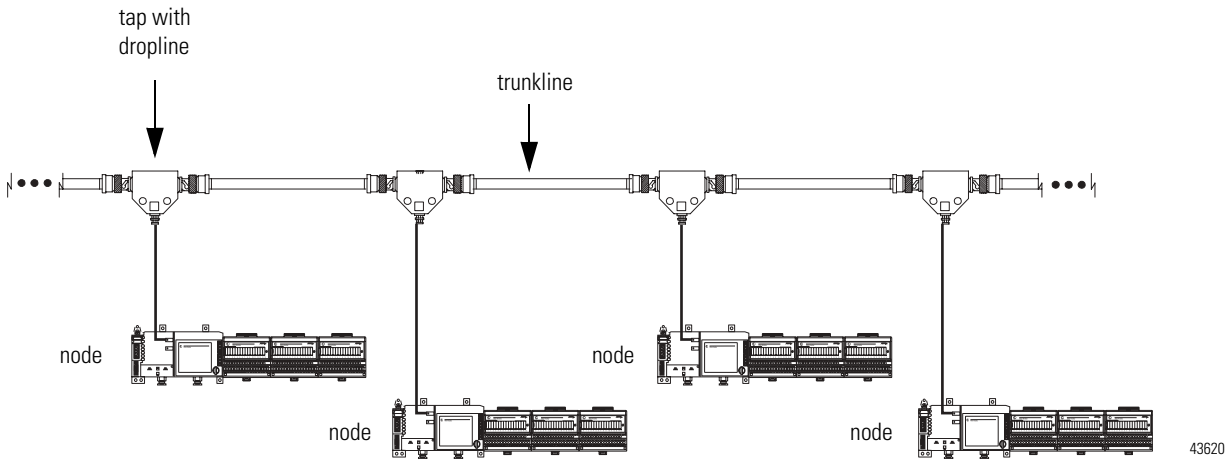


Figure C.3 Example ControlNet System Star Topology

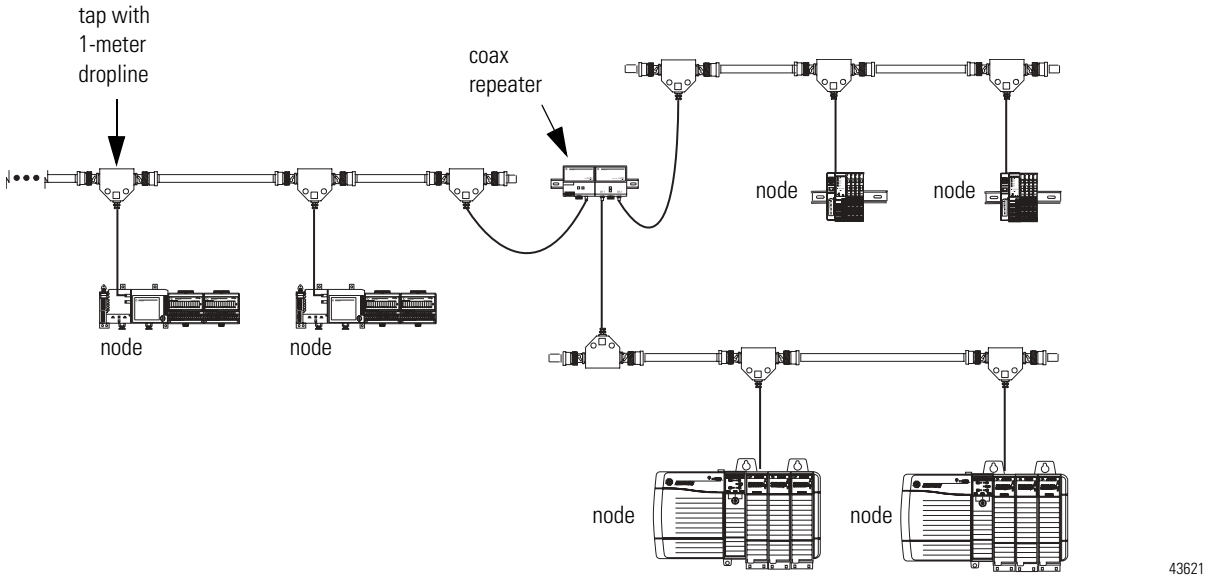
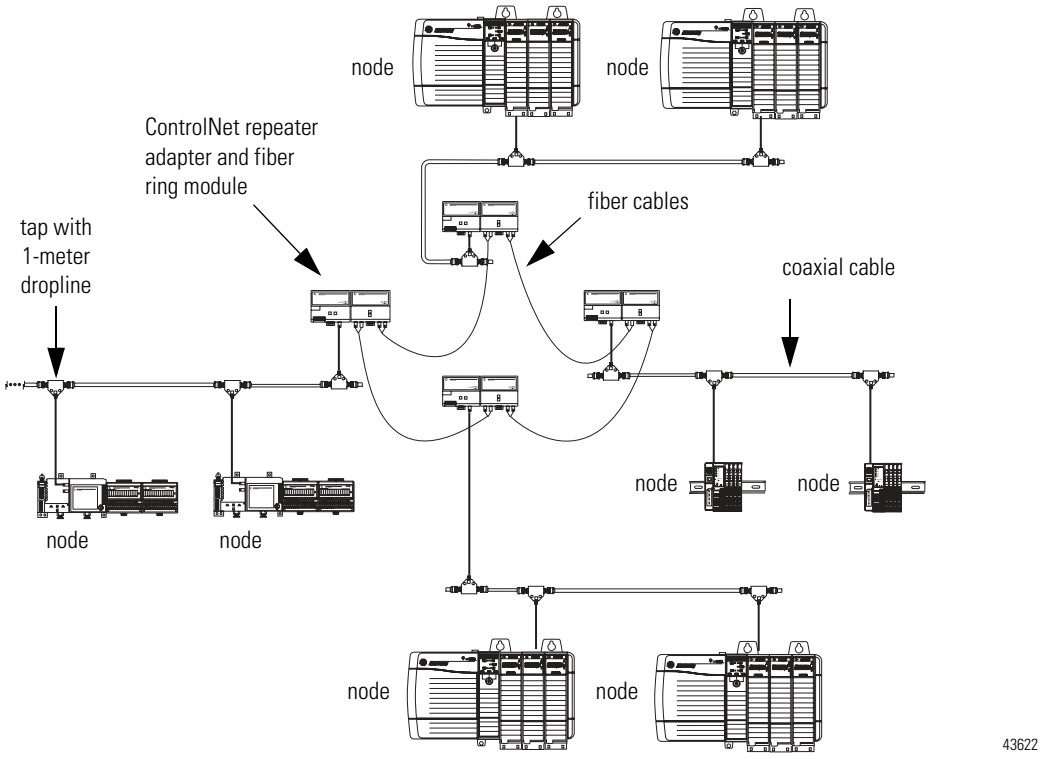


Figure C.4 Example ControlNet System Ring Topology



Number of Nodes

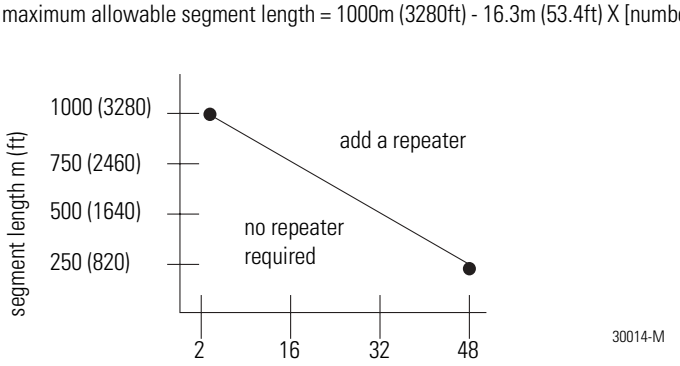
Each ControlNet network supports up to 99 nodes. Logix5000 controllers support multiple ControlNet networks, giving you the flexibility to add more nodes to your ControlNet network, or to boost performance.

Distances

In a ControlNet network, the maximum distance depends on the number of nodes on a segment; a segment is a section of trunk between 2 terminators. Use repeaters to add more segments or gain more distance.

Use Figure C.5 to determine whether repeaters are required.

Figure C.5



Note: This graph assumes 1786-RG6 usage.

Related Documentation

Table C.3 lists ControlNet products and documentation that may be valuable as you program your application.

Table C.3 Related Documentation

Catalog Number:	Title:	Publication Number:
1756-CNB, 1756-CNBR	ControlLogix ControlNet Bridge Module Installation Instructions	1756-IN571
1784-PCC	ControlNet PCMCIA Communication Card Installation Instructions	1784-IN034
1784-PCIC, 1784-PCICS	ControlNet PCI Communication Interface Card Installation Instructions	1784-IN003
1788-CNC, 1788-CNCR	ControlNet Daughtercard Installation Instructions	1788-IN002
1788-CNF, 1788-CNFR	ControlNet Daughtercard Installation Instructions	1788-IN005
1794-ACNR	FLEX I/O ControlNet Adapter Module Installation Instructions	1794-IN101
1734-ACNR	POINT I/O ControlNet Adapter Installation Instructions	1734-IN582
	POINT I/O ControlNet Adapter User Manual	1734-UM008
Networks Series	NetLinx Selection Guide	NETS-SG001
1786-RG6 and 1786-RG6F	ControlNet Standard and High-flex Coax Cable Installation Instructions	1786-IN009
1786 Series	ControlNet Fiber Media Planning Installation Guide	CNET-IN001
	ControlNet Media System Components List	AG-PA002
1786 Series	ControlNet Coax Media Planning and Installation Guide	CNET-IN002

To obtain these publications, go to either of the following:

http://www.theautomationbookstore.com

http://www.ab.com/manuals

Other ControlNet publications are available at:

http://www.ab.com/manuals/cn/controlnet.htm

Determining Your ControlNet Media Requirements

Using This Appendix

Use this appendix to determine your network media requirements.

After reading this appendix, consult engineering drawings of your facility for specific information concerning the best location to install the ControlNet network.

IMPORTANT The ControlNet cable system is a ground-isolated network. Proper selection of cable, connectors, accessories, and installation techniques are necessary to make sure it is not accidentally grounded. If conditions occur where other means are needed to ensure no metal to ground connections, items like blue tape can be used. Any accessories should have a dielectric rating of greater than 500 V.

Designing a ControlNet Media System

The design of a ControlNet media system is a process of measurement and judgement. The objective is to select the ControlNet media that will serve as the foundation for the network operations. When designing a network for an application, you must address the following deciding factors to assure a steady control foundation:

- Application Requirements
- Media Needs
- ControlNet Media Components

Application Requirements

Application requirements are environmental factors that, if not considered in the network design, could limit or prevent network operation. Application requirements are important in making the following decisions:

- What type of cable is needed?
- What type of cable connectors are needed?

The following application requirements should be factored into a network design as well:

- High ambient temperature
- EMF noise
- Flooding
- Hazardous environments

Media Needs

Media needs are the physical requirements of a network and are measured against the limitations of the media used. If the media needs are addressed without regarding the media limitations, then this oversight could result in a weak or unusable signal that could halt network operation. Media needs are important in making the following decisions:

- How much cable is needed?
- How is the programming device connected?

The following media needs should be factored into a network design:

- Network length from first device to last device

- Ability to configure the network from any device connected to the network

ControlNet Media Components

ControlNet network media components provide flexibility when designing a communications network for a particular application. A ControlNet network consists of a combination of the media components listed in Table D.1:

Table D.1

Component:	Definition:
Trunk cable	A bus or central part of a network media system that serves as a communications channel between any two points on a network.
Cable connector	A piece of hardware for mating and demating network media and devices.
Repeater	A piece of hardware that receives a signal on a cable, amplifies the signal, and then retransmits it along the next segment of the cable.
Terminator	A piece of hardware attached to the end-points of a network to absorb signals so that they do not reflect back to create interference with other signals.
Tap	A piece of hardware that acts as a communications link between the network and a device, extracting a portion of the signal from the trunk cable.
Node	A connection point with the programmed or engineered capability to recognize and process incoming data or transmit data to other nodes.

Determining How Many Taps You Need

The number of taps you need depends on the number of devices you want to connect to the network. You need a tap for each node and fiber hub on a segment.

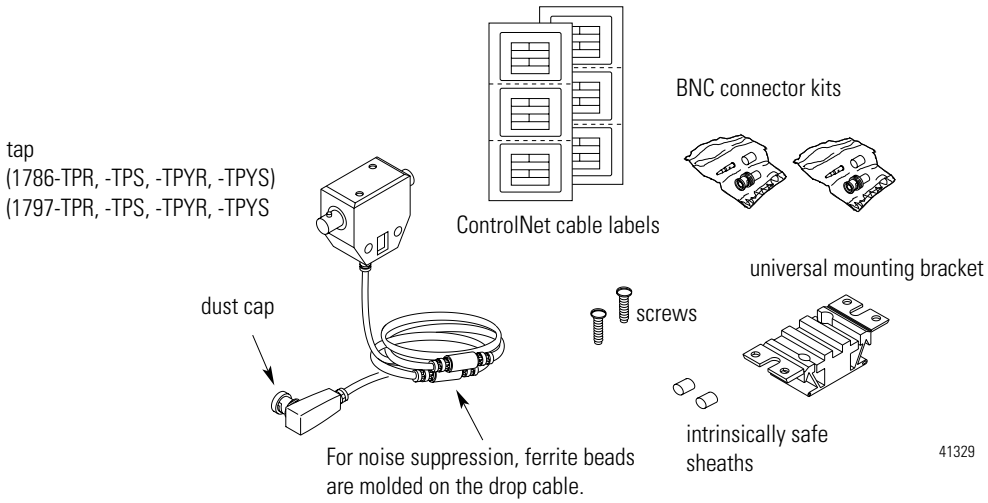
If you plan to add nodes at a later date, you should consider ordering and installing the cable and connectors for these additional nodes when you install the initial network. This will minimize disruption to the network during operation.

IMPORTANT A disconnected drop cable can cause noise on the network. Because of this, we recommend having **only one** unconnected drop cable per segment for maintenance purposes. Be sure to keep the dust cap on any unconnected drop cable. If your cable system requires more than one unconnected drop cable, unused drop cables should be terminated with a tap terminator (e.g. 1786-TCAP).

TIP If you are planning future installation of additional nodes, do not install the tap. Instead, install a BNC bullet connector. For more information on BNC connectors, see page D-15.

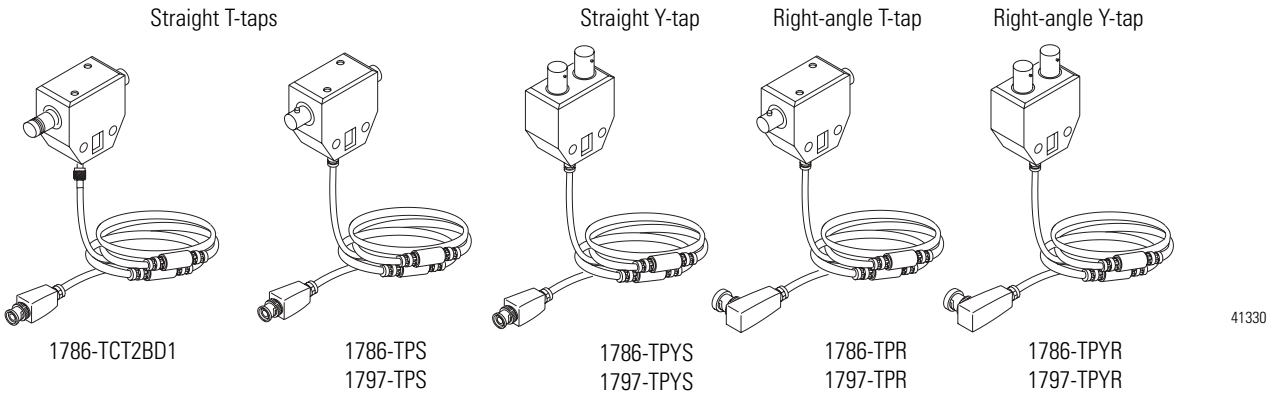
Each tap kit contains:

Figure D.1



These tap kits are available:

Figure D.2

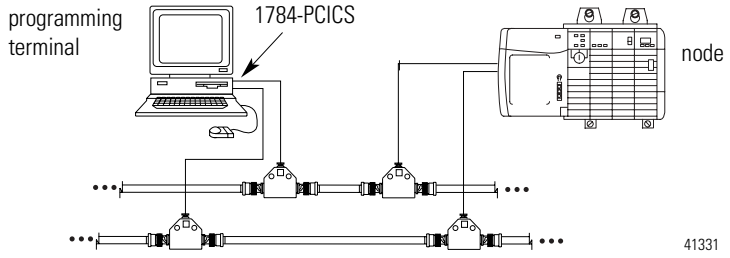


Connecting Programming Devices

Programming devices in non-hazardous areas may be connected to the ControlNet cable system through a 1784-PCIC, 1784-PCICS or 1784-PCC communication card. The 1784-PCIC and 1784-PCICS cards connect to the network using a ControlNet tap.

Figure D.3

Using a 1784-PCICS communication card on coax media



Determining What Type Of Cable You Need

There are several types of RG-6 quad shield cable that may be appropriate for your installation, depending on the environmental factors associated with your application and installation site.

IMPORTANT You should install all wiring for your ControlNet cable system in accordance with the regulations contained in the National Electric Code (or applicable country codes), state codes, and applicable municipal codes. All metal connectors must be insulated from the ground.

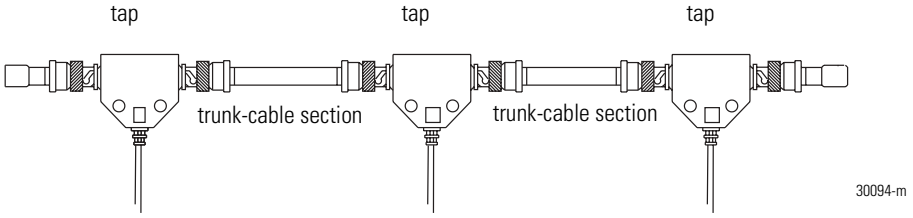
Table D.2

For:	Use this cable type:
light industrial applications	Standard-PVC CM-CL2
heavy industrial applications	Lay-on Armoured and Interlocking Armour
high and low temperature applications, as well as corrosive areas (harsh chemicals), low smoke generation and low flame spread	Plenum-FEP CMP-CL2P
festooning or flexing applications	High Flex
moisture resistant applications; direct burial, with flooding compound, fungus resistant	Flood Burial

Determining Trunk-Cable Section Lengths

A segment is comprised of several sections of trunk cable separated by taps between 75Ω terminators. The total cable length of a segment is equal to the sum of all of the trunk-cable sections.

Figure D.4



IMPORTANT

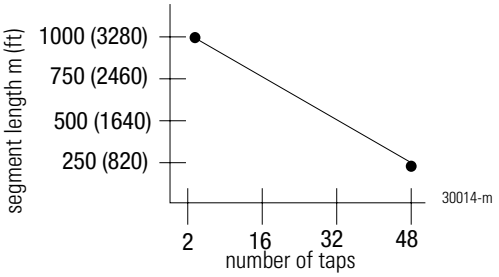
When determining the cable length of trunk-cable sections, make sure you measure the actual cable path as it is routed in your network. Consider vertical dimensions as well as horizontal dimensions. You should always calculate the three-dimensional routing path distance when determining cable lengths.

For intrinsically-safe applications, make sure to cover all exposed metal with either the intrinsically safe sheaths or other forms of insulation.

Select the shortest path for routing the cable to minimize the amount of cable you need. The specific details of planning such a cable route depends on the needs of your network.

The total allowable length of a segment containing standard RG-6 quad shield cable depends upon the **number of taps** in your segment. There is **no minimum** trunk-cable section length requirement. The maximum allowable total length of a segment is 1,000m (3,280ft) with two taps connected. Each additional tap decreases the maximum length of the segment by 16.3m (53ft). The maximum number of taps allowed on a segment is 48 with a maximum length of 250m (820ft).

maximum allowable segment length = 1000m (3280ft) - 16.3m (53.4ft) X [number of taps - 2]



EXAMPLE

If your segment requires 10 taps, the maximum segment length is:

1000m (3280ft) - 16.3m (53.5ft) x [10 - 2]

1000m (3280ft) - 130.4m (427.7ft) = **869.6m (2852.3ft)**

The amount of high-flex RG-6 cable you can use in a system is less than the amount of standard RG-6 cable due to higher attenuation, so you should keep high-flex cable use to a minimum. Use BNC bullet connectors to isolate areas that require high-flex RG-6 cable from areas that require standard RG-6 cable; this allows the high-flex RG-6 section to be replaced before flexture life is exceeded.

An allowable total length of RG-6 flex cable segment in your application can be determined using the equation below. Each additional tap decreases the maximum length of the segment. The maximum number of taps allowed on a segment is 48. Each additional tap decreases the maximum length of the segment by different lengths depending on the attenuation of your high-flex cable.

$$\text{maximum allowable segment length of cable} = \frac{\text{(20.29 db - [number of taps in segment * .32 db])}}{\text{cable attenuation @ 10MHz per 304 m (1000 ft)}}$$

Cable attenuation is defined as the signal loss measured at 10 MHz per 1000 ft (304 m) of cable.

EXAMPLE

If your segment requires 3 taps using 1786-RG6F/B[(1)] cable, the maximum segment length is:

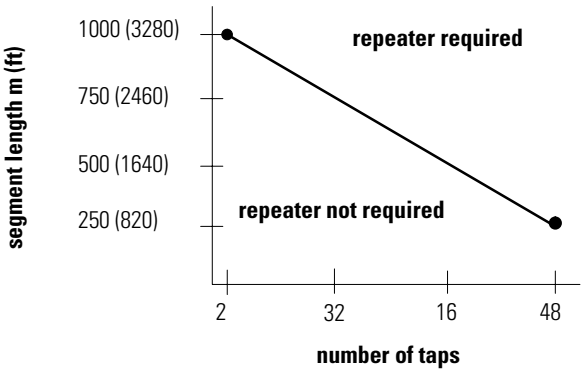
(20.29 db - [3 X.32 db]) / (13.5 db/1000)

(19.33 db) / (13.5 db/1000) = 1431.8ft (436m)

(1) 1786-RG6F/B cable has an attenuation of 13.5 db/1000 ft at 10MHz. 1786-RG6 cable has an attenuation of 5.99 db/1000 ft at 10MHz.

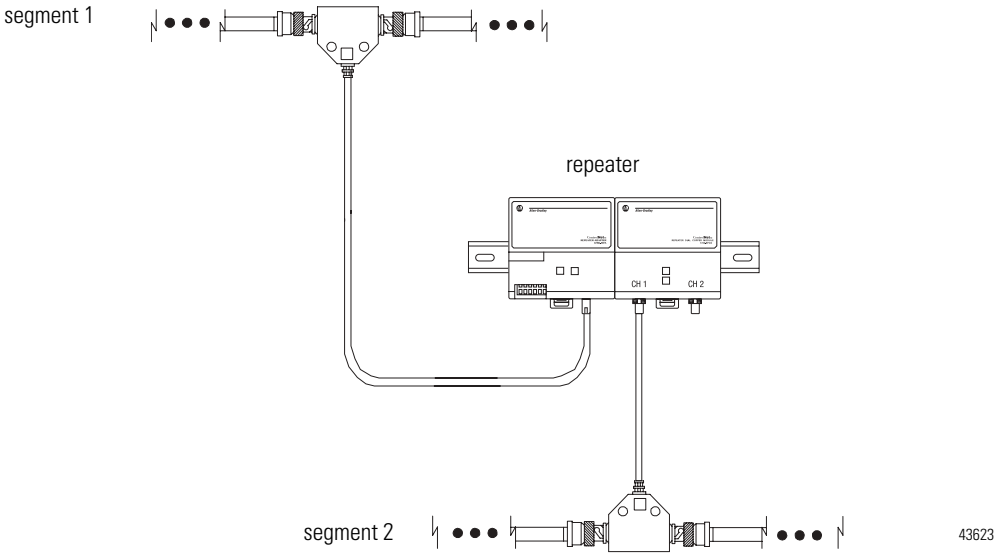
Determining if You Need Repeaters

You can install repeaters on a segment to increase the total trunk-cable length or number of taps. This creates another segment. You need to install repeaters if your system requires more than 48 taps per segment, or a longer trunk cable than the specifications allow.



The maximum number of addressable nodes per network is 99. Since repeaters **do not require** an address, they do not count against the total of 99. Repeaters do require a tap and, therefore, can affect the length of the segment.

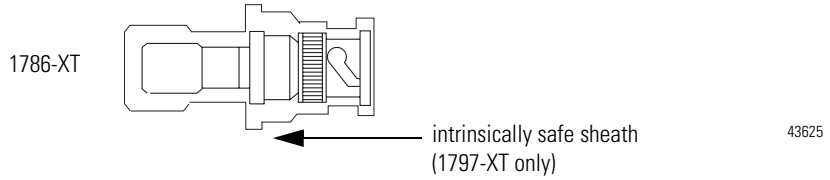
Figure D.5



Determining How Many Trunk Terminators You Need

You must use 75Ω trunk terminators (cat. nos. 1786-XT and 1797-XT) to terminate each segment for the ControlNet cable system. You need two XT terminators per segment because you need one for each end of the segment.

Figure D.6



After you have determined how many segments will be in your network, multiply this number by two to figure out how many terminators you will need for your network.

Be sure to cover the exposed metal using the intrinsically safe sheath provided with each terminator in order to comply with intrinsic safety standards. The 1786-XT and 1797-XT trunk terminators are the same mechanically and electrically. You can mix these terminators in non-intrinsically safe environments. However, you must only use the 1797-XT terminators in intrinsically safe environments (i.e., to maintain your application's Ex rating).

Configuring Your Link With Repeaters

When you configure your link using repeaters, you can install them in one of three ways:

You can install repeaters in	Using a maximum of	See
series	20 repeaters	page D-12
parallel	48 repeaters	page D-13
a combination of series and parallel	20 repeaters in series; 48 repeaters in parallel	page D-14

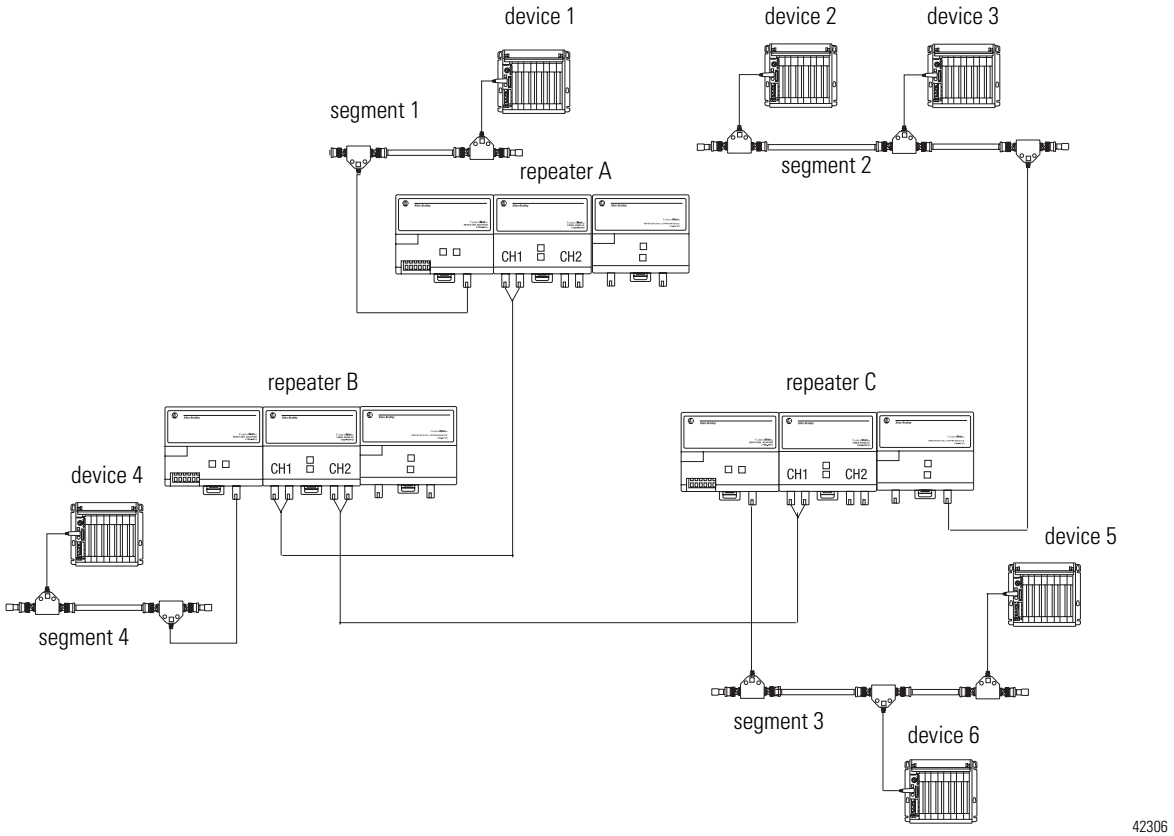
IMPORTANT A repeater can be connected to a segment at any tap location.

Installing Repeaters In Series

When you install repeaters in series, you can install **a maximum of 20 repeaters** (or 21 segments) to form a link. In the link below:

- there are 3 repeaters in series (A, B and C)
- segments 1 and 4 each have 2 taps and each = 1000m (3280ft) maximum length
- segments 2 and 3 each have 3 taps and each = 983.7m (3226.6ft) maximum length

Figure D.7

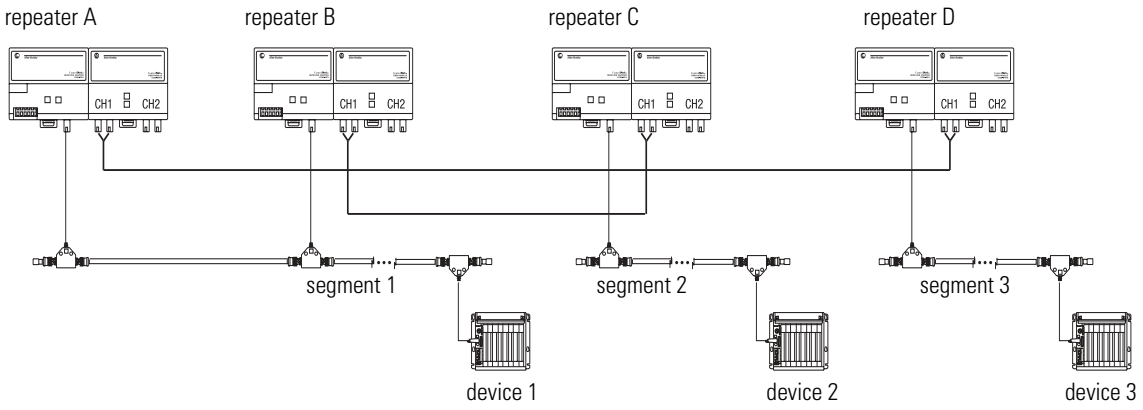


For any given architecture, the highest number of repeaters that a message might travel through to get from any single node to another determines the number of repeaters in series.

Installing Repeaters In Parallel

When you install repeaters in parallel, **you can install a maximum of 48 repeaters** (the maximum number of taps per 250m segment) to form a link. Figure D.8 shows an example of repeaters used in parallel.

Figure D.8



Repeaters A and B are in parallel off of segment 1. This network also has a maximum of 2 repeaters in series because the highest number of repeaters a message can travel through between any two nodes is 2 (i.e., if a message travels from device 1 to device 2 or 3, it travels through 2 repeaters).

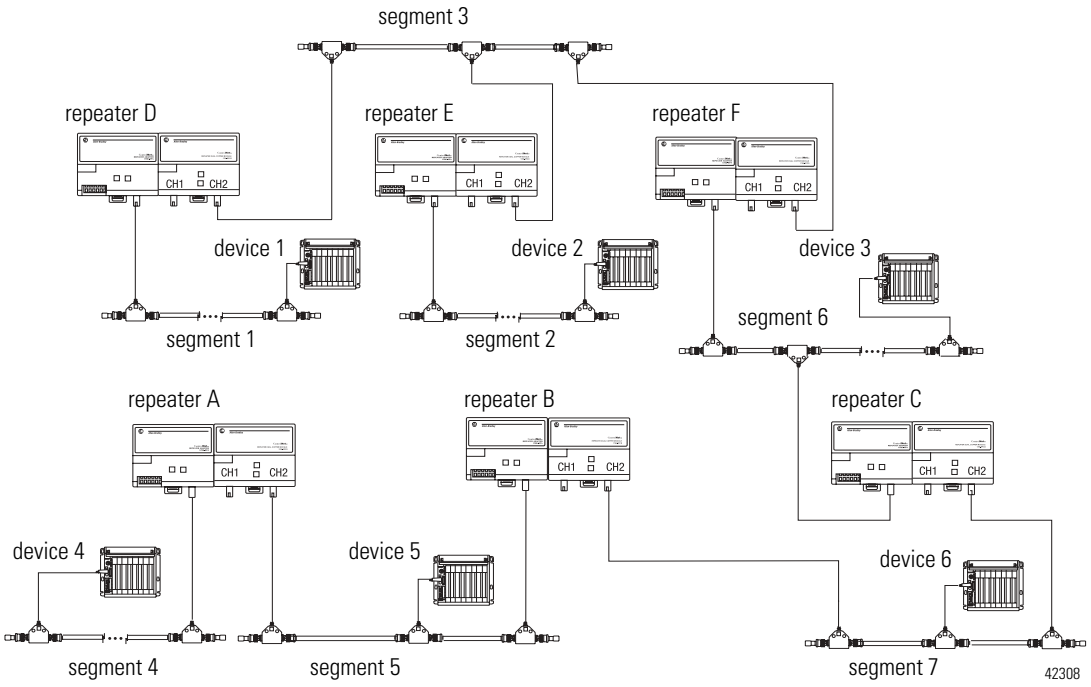
Installing Repeaters In A Combination Of Series And Parallel

You can install repeaters in a combination of series and parallel connections following the guidelines listed for each to form a link. For mixed topologies (series and parallel) the maximum number of repeaters in series between any two nodes is twenty.

Figure D.9

Repeaters D, E and F are installed in parallel.

Repeaters A, B and C are installed in series and connected to the repeaters in parallel via segment 6.



This network has a maximum of 5 repeaters in series because the highest number of repeaters a message can travel through between any two nodes is 5 (i.e., if a message travels from device 1 or 2 to device 4, it travels through 5 repeaters).

Determining What Type Of Connectors You Need

Depending on the type of connection you need to make, you can select from multiple Rockwell Automation ControlNet connectors. The following are examples of connections you may need to make in your ControlNet application:

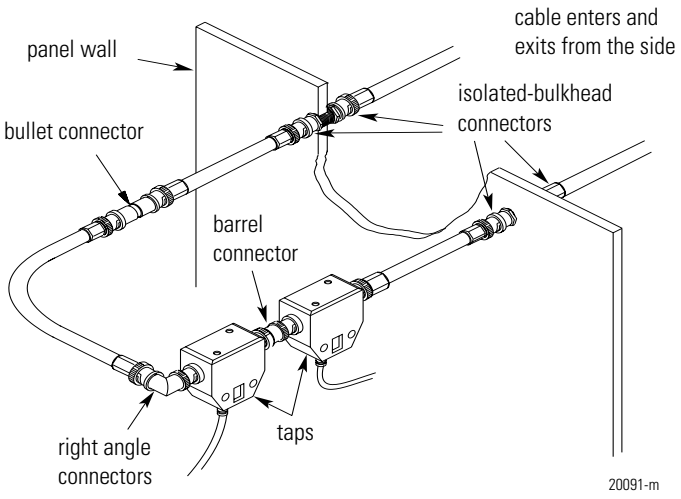
- IP20 BNC connections
- make ControlNet segments using copper coax media
- make water-tight (IP67), ruggedized TNC connections
- make pre-made, short-distance fiber media connections
- make connections to devices in your network in a hazardous environment
- isolate a ControlNet segment from a hazardous area to a non-hazardous area

To see a full list of the connectors available for these and any other connections in your ControlNet application, see the NetLinx Selection Guide, publication number NETS-SG001.

EXAMPLE

In this example, ControlNet cable:

- enters and exits the panel enclosure from the side using isolated-bulkhead connectors
- contains two adjacent taps connected by a barrel connector
- reserves one future tap location with a bullet connector
- makes a sharp bend with a right angle connector



ATTENTION

Do not let any metallic surfaces on the BNC connectors, plugs, or optional accessories touch grounded metallic surfaces. This contact could cause noise on the network. All exposed metal must be covered with either intrinsically safe blue sheaths or another form of sufficient insulation.

IMPORTANT

If you are installing a bullet connector for future tap installations, count the bullet as one of the tap allotments on your segment (and decrease the maximum allowable cable length by 16.3m [53.5ft]).

This helps you avoid reconfiguring your network when you install the tap.

Using Redundant Media

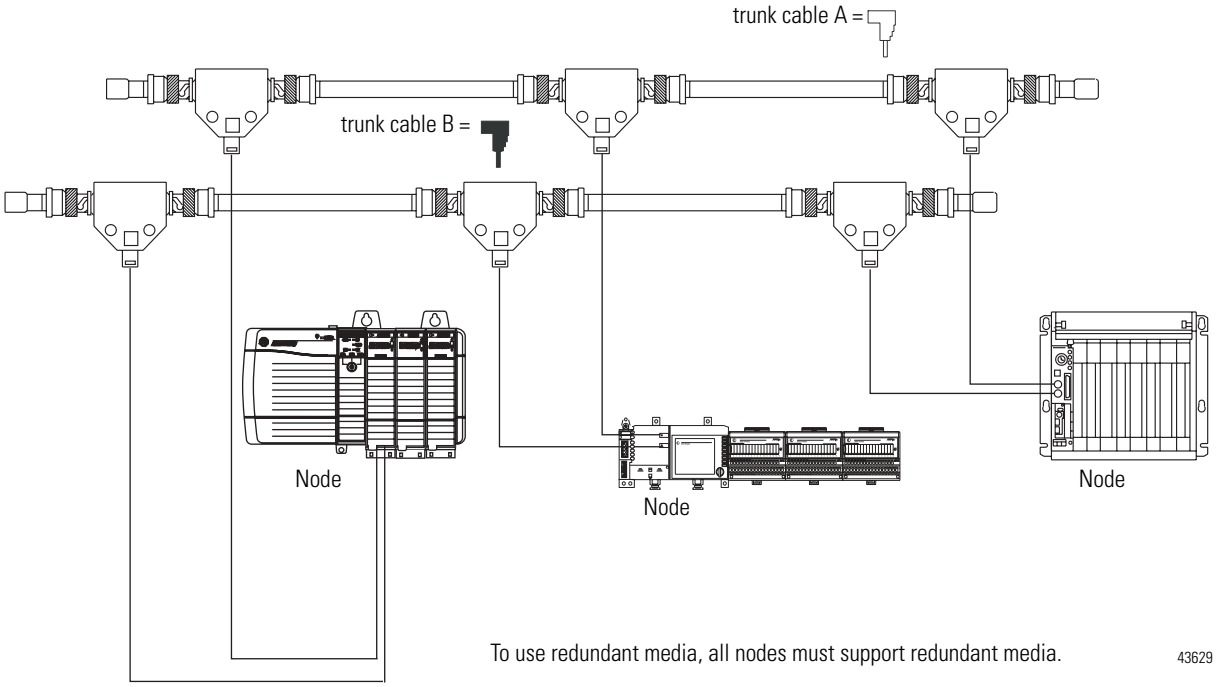
You can run a second trunk cable between your ControlNet nodes for redundant media. With redundant media, nodes send signals on two separate segments. The receiving node compares the quality of the two signals and accepts the better signal to permit use of the best signal. This also provides a backup cable should one cable fail.

Trunk cables on a redundant cable link are defined by the segment number and the redundant trunk-cable letter.

Actual ControlNet products are labeled with these icons  (the shaded icon representing redundant media).

In Figure D.10, the redundant cable trunk cable is trunk cable B. 

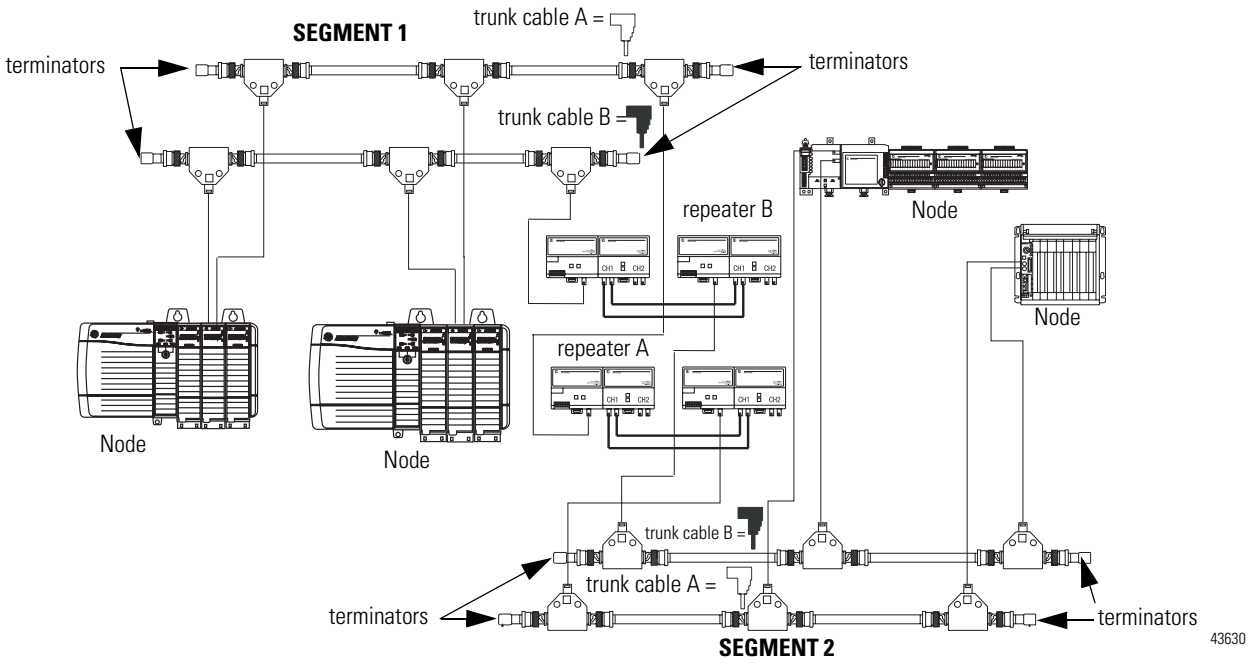
Figure D.10



Observe these guidelines when planning a redundant media system in a hazardous area.

- Route the two trunk cables (trunk cable A and trunk cable B) differently to reduce the chance of both cables being damaged at the same time.
- Each node on a redundant-cable link must support redundant coax connections and be connected to both trunk cables at all times. Any nodes connected to only one side of a redundant-cable link will result in media errors on the unconnected trunk cable.
- Install the cable system so that the trunk cables at any physical device location can be easily identified and labeled with the appropriate icon or letter. *Each redundant ControlNet device is labeled so you can connect it to the corresponding trunk cable.*
- Both trunk cables (trunk cable A and trunk cable B) of a redundant-cable link must have identical configurations. Each segment must contain the same number of taps, nodes and repeaters. *Connect nodes and repeaters in the same relative sequence on both trunk cables.*
- Each side of a redundant-cable link may contain different lengths of cable. The total difference in length between the two trunk cables of a redundant-cable link must not exceed 800m (2640ft).

Figure D.11



To use redundant media, all nodes must support redundant media.

IMPORTANT

Make sure you do not mix A and B cable connections in a redundant operations. A node supporting redundant trunk-cable connections will function even if trunk cable A is connected to the B connector on the node and vice-versa. However, this makes cable fault indications (on the hardware or in software) difficult to interpret and makes locating a bad cable segment extremely difficult.

When in redundant cable mode, each node independently decides whether to use channel A or channel B. This decision is based on error counters internal to each node. Redundant cabling is only valid if there is only one fault on the network. In other words, if you have a proper redundant cabling system and you remove node 3 on trunk A and node 4 on trunk B the system will not operate correctly because a double failure has occurred.

Application Considerations

The guidelines in this section coincide with the guidelines for "the installation of electrical equipment to minimize electrical noise inputs to controllers from external sources" in IEEE standard 518-1982. When planning your cable system there are certain installation considerations depending on your application. There are three categories of conductors:

Table D.3

Category:	Includes:
1	• ac power lines • high-power digital ac I/O lines • high-power digital dc I/O lines • power connections (conductors) from motion drives to motors
2	• analog I/O lines and dc power lines for analog circuits • low-power digital ac/dc I/O lines • low-power digital I/O lines • ControlNet communication cables
3	• low-voltage dc power lines • communication cables to connect between system components within the same enclosure

ATTENTION

These guidelines apply only to noise coupling. Intrinsic safety requirements for cable mounting are of the highest priority.

General Wiring Guidelines

Follow these guidelines with regard to noise coupling. Intrinsic safety requirements should prevent most or all of these situations from occurring. They are provided as a general reference for wiring.

- If it must cross power feed lines, it should do so at right angles.
- Route at least 1.5m (5ft) from high-voltage enclosures, or sources of rf/microwave radiation.
- If the conductor is in a metal wireway or conduit, each section of that wireway or conduit must be bonded to each adjacent section so that it has electrical continuity along its entire length, and must be bonded to the enclosure at the entry point.

For more information on general wiring guidelines, see the *Industrial Automation Wiring and Grounding Guidelines* (publication 1770-4.1).

Wiring External To Enclosures

Cables that run outside protective enclosures are relatively long. To minimize cross-talk from nearby cables, it is good practice to maintain maximum separation between the ControlNet cable and other potential noise conductors. You should route your cable following these guidelines:

Table D.4

Is the cable in a contiguous metallic wireway or conduit?	Route your cable at least:	From noise sources of this strength:
Yes	0.08m (3in)	Category-1 conductors of less than 20A
	0.15m (6in)	ac power lines of 20A or more, up to 100 KVA
	0.3m (12in)	ac power lines greater than 100 KVA
No	0.15m (6in)	Category-1 conductors of less than 20A
	0.3m (12in)	ac power lines of 20A or more, up to 100 KVA
	0.6m (24in)	ac power lines greater than 100 KVA

Wiring Inside Enclosures

Cable sections that run inside protective equipment enclosures are relatively short. As with wiring external to enclosures, you should maintain maximum separation between your ControlNet cable and Category-1 conductors.

When you are running cable inside an enclosure, route conductors external to all raceways in the same enclosure, or in a raceway separate from Category-1 conductors.

Table D.5

Route your cable at least this distance:	From noise sources of this strength:
0.08m (3in)	Category 1 conductors of less than 20A
0.15m (6in)	ac power lines of 20A or more, up to 100 KVA
0.6m (24in)	ac power lines greater than 100 KVA

Surge Suppression

Transient electromagnetic interference (emi) can be generated whenever inductive loads such as relays, solenoids, motor starters, or motors are operated by “hard contacts” such as push-button or selector switches. These wiring guidelines assume you guard your system against the effects of transient emi by using surge-suppressors to suppress transient emi at its source.

Inductive loads switched by solid-state output devices alone do not require surge suppression. However, inductive loads of ac output modules that are in series or parallel with hard contacts require surge-suppression to protect the module output circuits as well as to suppress transient emi.

Ferrite Beads

Ferrite beads can provide additional suppression of transient emi. Fair-Rite Products Corporation manufactures a ferrite bead (part number 2643626502) which can be slipped over category-2 and category-3 (RG-6 type trunk cable) conductors. You can secure them with heat-shrink tubing or tie-wraps. A cable transient emi induced onto the cable can be suppressed by a ferrite bead located near the end of the cable. The ferrite bead will suppress the emi before it enters the equipment connected to the end of the cable.

Ordering Components

Now that you are ready to begin ordering components, use these guidelines to help you select components.

General Planning

The ControlNet cable system is isolated from earth and *must* be protected from inadvertent ground connections.

Segment Planning

- all connections to the trunk cable require a tap
- taps may be installed at any location on the trunk cable
- tap drop-cable length must not be changed (fixed at 1 meter)
- maximum number of taps = 48, with 250m (820ft) of standard RG6 trunk cable
- maximum trunk-cable length of standard RG6 trunk cable = 1000m (3280 ft), with 2 taps
- 75Ω trunk terminators are required on both ends of a segment
- one tap with an unconnected drop cable may be installed for maintenance purposes
- use ControlNet tap terminators (1786-TCAP) for all other unconnected drop cables
- use BNC bullet connectors at future tap locations
- do not mix redundant and non-redundant nodes when redundant cabling is desired
- avoid high noise environments when routing cables

Link Planning

- maximum of 99 nodes (excluding repeaters)
- repeaters require a tap but are not counted as nodes — they are included in the number of devices allowed per segment (48)
- repeaters may be installed at any tap location along a segment
- there can only be one path between any two points on a link
- the configuration of both sides of a redundant segment must be the same
- the total cable difference between the two sides of a redundant link can not exceed 800m (2640ft)

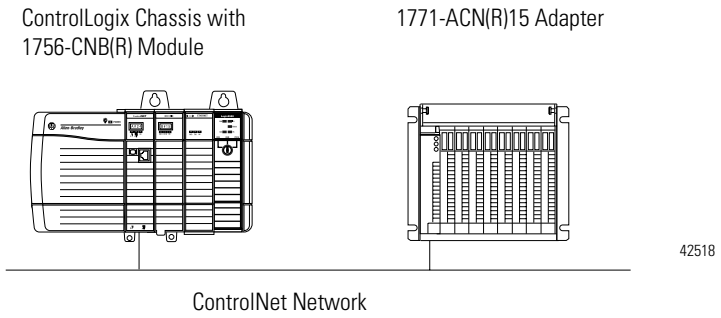
Notes:

Controlling 1771 I/O Over ControlNet

Using This Appendix

Use this appendix to monitor and control I/O devices that are wired to 1771 I/O modules when a:

- 1756-CNB(R) module connects the local chassis to a ControlNet network.
- 1771-ACN(R)15 adapter connects the 1771 I/O modules to the same ControlNet network.



How to Use This Procedure

If you have not already done so in a previous procedure, do the following preliminary task:

- Add the Local 1756-CNB(R) Module

To complete this procedure, do the following tasks:

- Add the 1771-ACN(R)15 Module
- Communicate with Block Transfer Modules, using either of these procedures:
  - Read or Write Data To or From a Block Transfer Module Via a Message Instruction
- Addressing I/O

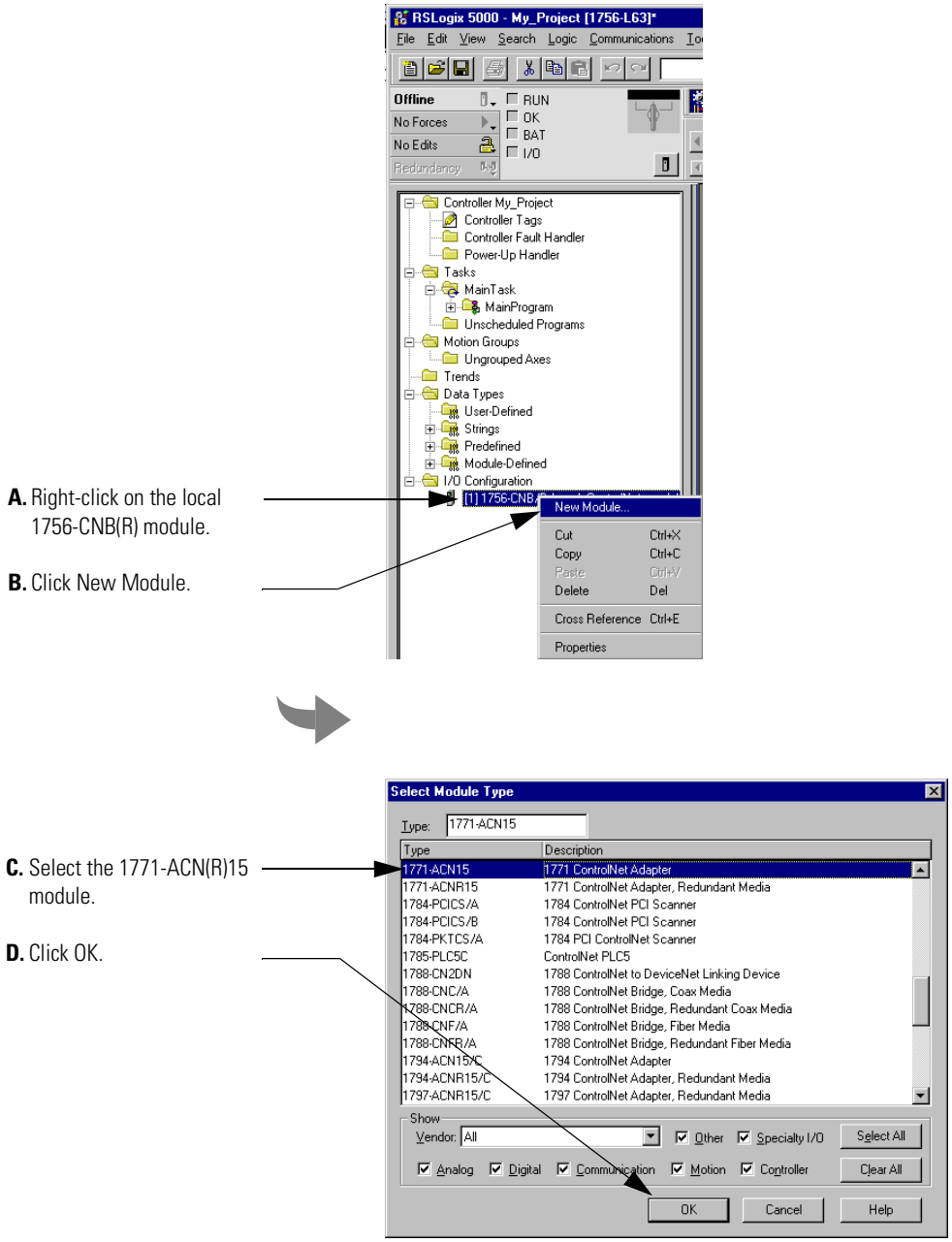
Add the Local 1756-CNB(R) Module

For more information on how to do this, see page 4-10.

Add the 1771-ACN(R)15 Module

To transfer discrete data between remote 1771 I/O and the ControlLogix controller in the local chassis (via the 1756-CNB(R) module), you need to add a remote 1771-ACN(R)15 ControlNet adapter to the I/O configuration.

1. Add the 1771-ACN(R)15 module.



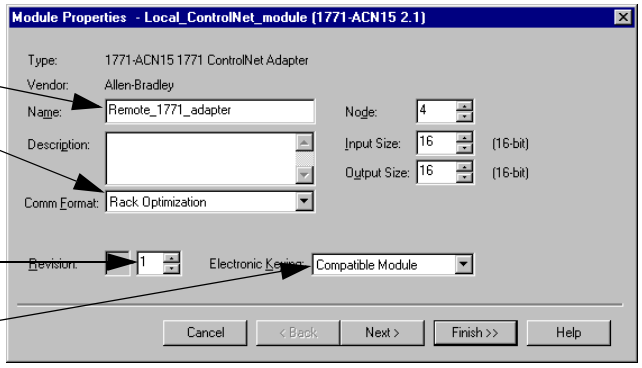
2. Configure the 1771-ACN(R)15 module.

A. Name the module.

B. Select a Comm Format. For more information on choosing a Comm Format, see page 3-8.

C. Select the module's Revision level.

D. Select an Electronic Keying level. For more information on choosing a keying level, see page 3-5.



E. Select the module's node number on ControlNet.

F. Select the Input Size.

G. Select the Output Size.

H. Click *Next*.

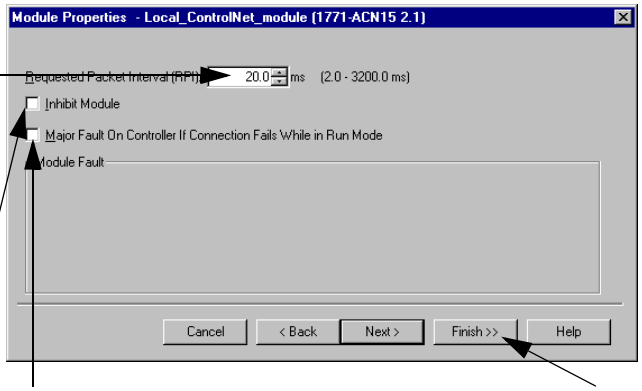
I. Set the RPI rate.

The RPI must be equal to or greater than the NUT. This parameter only applies if the module uses one of the Rack Optimized communication formats.

J. Inhibit the module, if necessary.

Initially, do you want the module to communicate with the controller?	**Then:**
Yes	Leave the box unchecked
No	Check the box[1]

[1] When you test this portion of the system, clear the check box.



K. Determine if you want a major fault on the controller if the connection to the PanelView fails in Run Mode.

If you want the controller to:	**Then:**
fault (major fault)	Select the check box
continue operating	Leave the check box unchecked[1]

[1] Monitor the connection using ladder logic.

L. Click *Finish*.

Read or Write Data To or From a Block Transfer Module Via a Message Instruction

Use this procedure to transfer data to or from a module that requires block transfers. Use an INT buffer in the message and move the data into or out of the buffer as needed because DINTs can increase the program scan.

Read Data From a Block Transfer Module

1. To read data from a block transfer module, enter the following rung of ladder logic:

Reads 16-bit integers (INTs) from the module and stores them in *int_buffer_read*. (Only include the *msg_write.EN* tag and associated instruction if you also send a block transfer write message to the same module.)

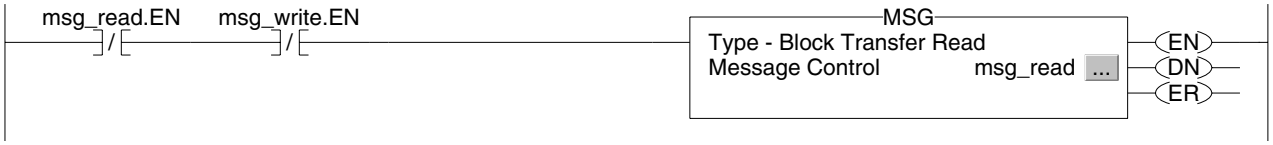


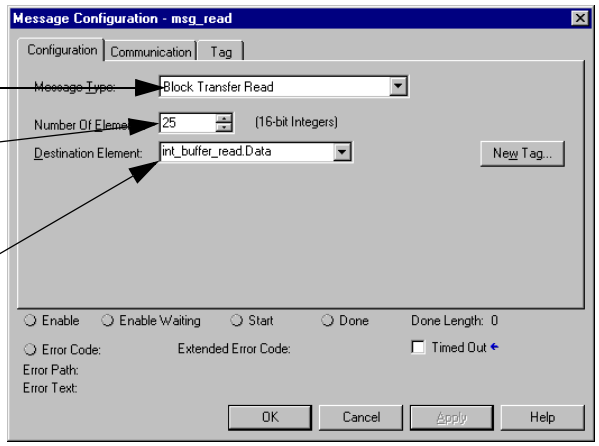
Table E.1 describes the tags used in this message

Table E.1

Tag Name:	Description:	Data Type:	Scope:
msg_read	block transfer read message	MESSAGE	*name_of_controller* (controller)

Configure the Message

1. In the MSG instruction, click ... .
2. Configure the message as shown below.



A. Select a Block Transfer Read message type.

B. Select the number of elements to read. In this case, the number of elements is the number of INTs to read.

C. Select the tag to hold the data that is read.

D. Use the Browse button to select a path for the message. To use this method, you must make sure the remote 1771 adapter was added to your project's I/O configuration.

E. Select ControlNet.

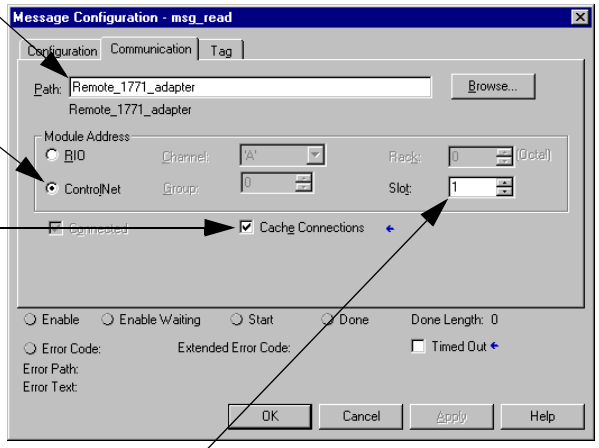
F. Cache the connection if 16 or fewer devices require the block transfer instructions.

If more than 16 devices require the block transfer instructions, determine whether this message is for one of the 16 devices that require the most frequent updates and follow the guidelines below:

- If the device for this message is among the 16 requiring most frequent updates, cache the connection.
- If not, do not cache the connection (i.e., leave the box unchecked).

For more information on caching connections, see page 6-4.

G. Set the physical slot location in the 1771 chassis.



Write Configuration or Output Data To a Block Transfer Module

1. To read data from a block transfer module, enter the following rung of ladder logic:

The MSG instruction sends the data in *int_buffer_write* to the module.

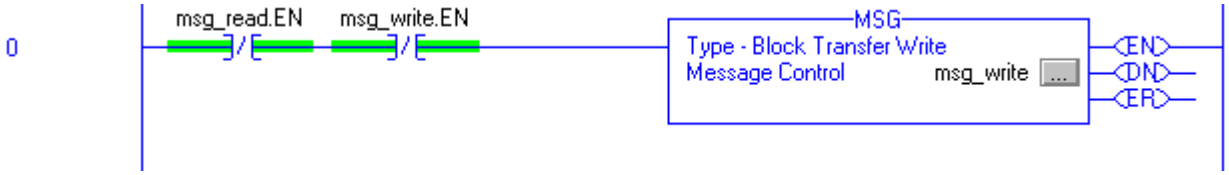


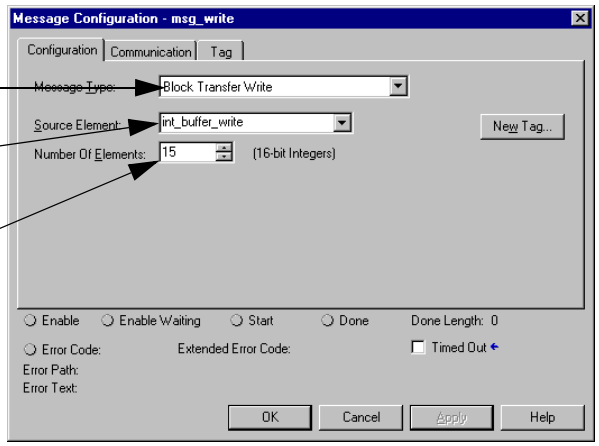
Table E.2 describes the tags used in this message

Table E.2

Tag Name:	Description:	Data Type:	Scope:
msg_write	block transfer write message to the same module	MESSAGE	*name_of_controller* (controller)

Configure the Message

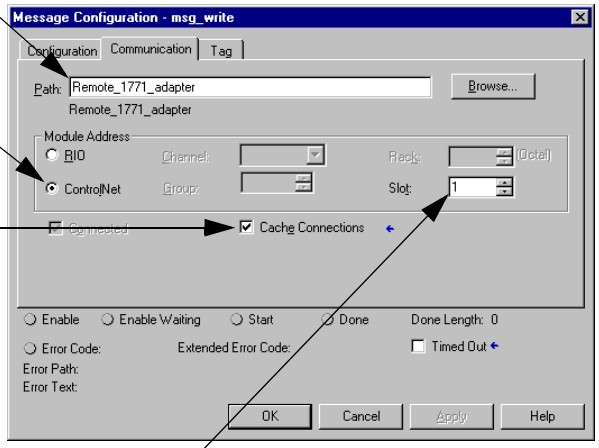
1. In the MSG instruction, click ... .
2. Configure the message as shown below.



A. Select a Block Transfer Write message type.

B. Select the tag where the data is written from; the tag should be INT.

C. Select the number of elements to write.



D. Use the Browse button to select a path for the message. To use this method, you must make sure the remote 1771 adapter was added to your project's I/O configuration.

E. Select ControlNet.

F. Cache the connection if 16 or fewer devices require the block transfer instructions.

If more than 16 devices require the block transfer instructions, determine whether this message is for one of the 16 devices that require the most frequent updates and follow the guidelines below:

- If the device for this message is among the 16 requiring most frequent updates, cache the connection.
- If not, do not cache the connection (i.e., leave the box unchecked).

For more information on caching connections, see page 6-4.

G. Set the physical slot location in the 1771 chassis.

Addressing I/O

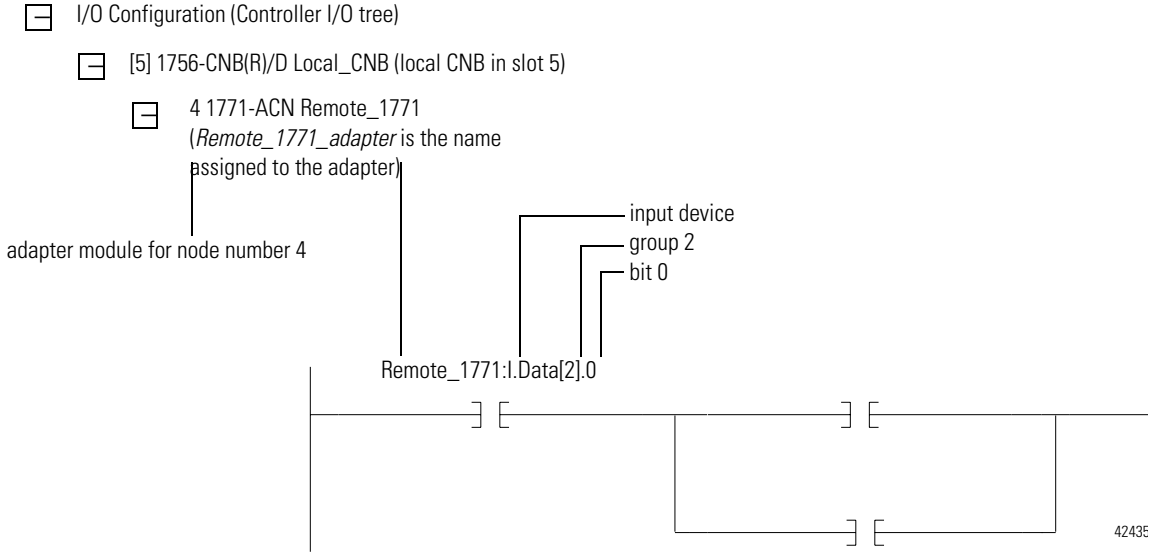
To monitor or control discrete 1771 I/O devices, assign the tag name of the device to an instruction in your logic:

- For step-by-step instructions on how to enter logic and tag names, see the *Logix5000 Controllers Common Procedures*, publication 1756-PM001.
- All the data for I/O modules is at the controller scope. As you assign addresses, click the *Controller Scoped Tags* button to see the I/O tags.
- Use the following table to select the address of an I/O device:

For a digital device:	Use this address:
	name:type. Data *[group].bit*

Where:	Is:	
name	the name of the remote I/O adapter, such as the user-defined *remote_1771_adapter* in the previous examples • Use the name for the rack that contains the module to which this device is wired. • Use the name from the I/O configuration folder of the controller.	
type	type of device:	
	If:	**Then:**
	input	I
	output	O
group	group number of the module to which this device is wired	
bit	point (bit) number to which this device is wired	

EXAMPLE Address a digital device that is wired to a 1771 I/O module



Notes:

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